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Vol. IX. NEW YORK, JAN. 15, 1887. No. 3.

CIVIL SERVICE REFORM has taken firm root, to judge by the examination required for the position of electrician to the Treasury Department at Washington. We have no doubt that a person answering the questions proposed, in an intelligent manner, is able to take efficient care of an electric lighting plant.

THE formal announcement is made in this issue of the meeting of the National Electric Light Association, at Philadelphia, on Feb. 15. The attendance already promises to be very large, several important papers are listed, and the preparations are well advanced. We advise every electric light man who can be present to attend.

THE voice of the alarmist is raised again as to the condition of the Statue of Liberty and the prospect of her early decay and destruction. But there really does not appear to be much occasion for fear and trembling, and we venture to stake our opinion with that of Gen. Stone as to the statue's power of endurance. Of course, the statue must be "kept up," but so must every large work in the open air.

IT is to be hoped that Mr. Beane's manly protest against the wild talk indulged in sometimes as to the danger of the electric light will have its due effect. There never was a safer illuminant than that afforded by the use of electricity. Of course, ordinary precautions must be taken with arc and incandescent lamps, but that is all that could be said of any other appliance of civilization, whether it be a steamship, an elevator, a gun or a carriage.

MAJOR GEN. WEBBER'S paper, that we are publishing, on the use and manufacture of glow lamps, suggests that, great as are the improvements that have been made in this field, greater lie before. Indeed, there is a well-defined report current that one of the most distinguished American inventors, devoting his attention chiefly to the subject, has already succeeded in far surpassing his previous work; and we have reason to believe the report to be true. The life of the lamps, long as it is, should be longer; their consumption of current per candle-power should be less; they should be less costly to make. And when we say that these things should be, we mean that they will be.

IN spite of the protection to railway travel which the telegraph affords, its present mode of application is such that unless good judgment on the part of train-men be called to its aid, disasters may and do occur. This was shown again in recent accidents causing a terrible loss of life. But some new systems eliminate most if not all of the elements of danger, in that communication can be kept up with the train at all times at or between stations. As Mr. Hall points out in another column, such a system could not have failed to avert the accidents which happened, and it is to be hoped that steps will be taken to prevent these railway disasters by the means now at our command.

THE prime mover best adapted for driving dynamos for domestic electric lighting is made the basis of competition for various medals by the London Society of Arts. The range of motors is quite extensive, and ought to bring out a fair number of competitors. With the best motors determined, however, the question of their individual application must always be largely a subject of choice, not only by the individual user, but also in accordance with circumstances. Nevertheless a knowledge of the true performance of each class is of great value in showing what form can be most economically applied in a given case. We hope that the competition will be a brisk one.

MR. STEPHEN D. FIELD replies this week to the criticism made on his method of motor regulation by Mr. S. S. Wheeler in a recent issue, and shows that his device removes the objection brought forward. Actual experiment has proved to Mr. Field the correctness of his assumption, and that sparking at regulating brushes does not take place. So delicate indeed are these in their operation, that when removed but a small fraction of an inch from their normal position they indicate a current and set the regulating motor in operation for their correction. We might add that construction on Mr. Field's electric locomotive is progressing rapidly, and that it will in due time be given a trial on the elevated railroads of this city.

REGARDING aluminum and its use as an element in the galvanic battery, Prof. Vander Weyde cites some interesting experiments in another column as to a peculiar behavior of that metal in the cell. Acting on the suggestion early made that aluminum might replace the platinum in the Grove battery, he tried the experiment but without success. When used as the electrode in a voltameter, decomposing water, it was also found that while aluminum could be used as the negative electrode, developing hydrogen upon its surface, the action of the cell ceased when the aluminum served as the positive electrode. This curious phenomenon is ascribed by Dr. Vander Weyde to the occlusion of oxygen by the aluminum which is then rendered incapable of further action.

THE French cable company has discovered that to be in a "pool" may as well be a means of losing money as any other, and that it is easier to get into a "pool" than to get out. It does look as though the Frenchmen had been badly treated, but, at the same time it is not easy to see how they can withdraw from the old contract, especially while the Western Union company holds their pole line in this country. Perhaps, this is only the beginning of troubles in the "pool," brought about not so much by any Commercial Cable intrigue, of which the first evidence has still to be produced, as by the energetic competition of that company. We should not be sorry to see the whole affair end in a return to fair rates, and then the companies giving the best service will earn the best income. After all, "pools" and "combinations" for monopoly, though they prosper and grow big for a time, come to their end. They carry in themselves the seeds of dissolution. They often commit suicide. The very stars in their courses fight against them.

THE success of the distribution of power by electricity has so well borne out the predictions we have constantly made for it, that its standing as an industry is now firmly established, and it is destined to a vast increase. In the beginning it was but natural that small power users should have availed themselves of the new method, but we now find that powers ranging up as high as 20 h. p. are called for in the electric motor. This has been the experience of Mr. Sprague, whose new 15 h. p. motor we illustrate this week. As a supplement to the work of the electric lighting, as well as an independent undertaking, electric power distribution presents a grand field to be developed. We have so often discussed the merits of the system that repetition is unnecessary, but a glance at its commercial profitableness in connection with electric lighting stations, will bear close study from those interested in the question.

OUR readers will find much to interest them in the description of the central station now in course of completion in Rome, Italy, for the purpose of distributing electricity by means of secondary generators on the Zipernowski-Deri system. The very full details which are given show that the system has certainly passed beyond the experimental stage, and that practical results can be obtained, and probably with great economy. One of the most remarkable points in connection with the system is the low resistance in the coils of the secondary generators. Though placed in a circuit of 1,750 volts, the ordinary primary coil has only 1.15 ohm resistance, and still a current of only 8.25 ampères passes through the coil. This result is brought about by the self-induction of the primary, which generates a high counter E. M. F. This same phenomenon was adverted to in a recent number in connection with Mr. J. E. H. Gordon's method of placing arc lamps on incandescent circuits using alternating currents, where the high counter E. M. F. acted as a safety device to protect the arc lamp. Regarded as converting machines, the secondary generators employed have a remarkable lightness as compared with their power. Thus a coil capable of delivering 7,200 watts, or about 9.6 horse-power, weighs only 255 pounds, which is equivalent to a weight of 26.5 pounds per horse-power. Compared with other "converters of energy" this is a very excellent showing. It is true that the conversion is not strictly from one form of energy to another, but is nevertheless a conversion, and shows especially the great flexibility and efficiency of electrical conversion. Regarding the particular installation under notice, it is interesting to observe that it is being erected by the Roman gas company, a fact which goes to prove that the Italian gas stockholders are also alive to the fact that to maintain their hold on public patronage they must supply its demands for electric light.

THE recent street car troubles in Brooklyn and Boston, have brought out very clearly the serious expense that has to be incurred in the maintenance of the horses, whenever, unfortunately, the companies and their men cannot agree as to wages and work. At such times, too, the horses run the risk of great suffering. It is obvious that with the use of cables or electricity, this element of trouble, in case of a strike, is eliminated. The men, seeking to enforce their views by "masterly inaction," can no longer be accused of cruelty to animals, and the employers are relieved of a very serious worry and expense. As to cables, it may be pointed out, however, that should only one car run, the big cable, taking 80 per cent. of the power generated, has to drag its weary length along, just the same as it would if it were loaded with fifty cars. In the case of electricity, whether with overhead wire, conduit or storage cell, just the power would be used, during any time of delay or interruption, that is required for the cars run and not a single horse-power more. This is unquestionably a great item of economy and must impress all interested. We do not wonder that under the circumstances the directors of the Third avenue road in this city are investigating the subject of electric motors, but we are somewhat surprised to see attributed to Mr. E. Lauterbach, their counsel, the remark that while the electric problem had been solved, it "had not been solved cheaply," and that as the road did not want to increase its running expenses, it might put a cable system in operation. The inference to be drawn from the remark as to the cost of electricity is utterly misleading. It may be that Mr. Lauterbach seeks diplomatically to get the rival bidders to "come down" in price, and it is natural that having tried the cable system, itself an innovation, the directors should for the present object to further experiments. But we venture to tell them, and to say it as strongly as we can, that electricity is cheaper than cables, and, as a system, infinitely more flexible. We should personally be glad to equip their road for them, electrically, at a considerable per cent. below any price they may get on cable systems.

NEW BOOKS.

ELEMENTS OF STATIC ELECTRICITY. By Philip Atkinson, A.M., Ph.D. New York: W. J. Johnston, publisher. 1887. 228 pp. 7¼ × 5¼ inches. Price $1.50.

Static electricity has been the subject of many treatises by numerous writers, but the subject is one requiring such clearness of expression for a full understanding by the unprepared student that few authors have succeeded in making their work alike instructive and interesting.

In reading the present work we are gratified to see that the author has presented the subject so clearly that the information given can be assimilated with ease. Such a work can evidently only proceed from the pen of one who has had long practical experience with the matter treated of, and who is able to present the results of his own personal observations. Dr. Atkinson, who has for many years made the study of static electricity his specialty, is already known to our readers by the series of articles which have appeared in our columns from time to time from him, and his method of discussing the subject in this book is on the same lines as were followed in the articles referred to.

The work is divided into fourteen chapters, each of which may be read independently, from the fact that it resembles very much a lecture complete in itself, notwithstanding the intimate connection between all of the sections. As the book is designed to be introductory to the science, mathematics have designedly been excluded from the text.

The first chapter of the book deals with the general phenomena of static electricity and furnishes the definition of static electricity. Then follow two chapters on potential and the nature of electricity in general. The latter section is a most excellent presentation of the current theory, supplemented by the author's own observations. This chapter may be said to contain the general plan upon which the author has carried out his whole work. He has assumed that electricity is one of the forms in which energy manifests itself; that its nature is not changed by the means employed to generate it, and that the various terms, *positive, negative, static, dynamic,* express certain conditions and relations in which this manifestation occurs, and not different kinds of electricity.

Static induction, distribution and condensation, or accumulation, form the subject of succeeding chapters in which are fully discussed the principles by which the action of the various generators of static electricity is easily explained. Then follow in natural course the descriptions of the machines, those of Holtz and Töpler being specially treated of in conjunction with a large number of experiments made with them illustrating the principles advanced. The author also describes fully the construction of the Töpler machine as improved by himself in a manner by which its efficiency is considerably increased.

The author in his treatment of the electric transmission in vacua departs from the explanation of the phenomena as given by Crookes, namely, that of the impact of the residual air molecules, and explains them upon the general theories already established.

The concluding three chapters of the book contain an excellent account of the phenomena of terrestrial and atmospheric electricity. The experiments made to determine the strength and direction of earth currents, the aurora, lightning, thunder and the like, are described with great clearness and minuteness.

Taken as a whole the book is a most useful treatise. Its great merit lies in the suggestive running commentaries of the author. The sixty-four illustrations inserted in the text are neatly executed, and the book generally is gotten up in admirable style. As the author requests the criticisms and suggestions of those interested in this subject, we might propose that the Wimshurst static machine, which is coming into deserved prominence, be given a place in the next edition of the book.

CONNECTIONS OF TELEGRAPH APPARATUS AND CIRCUITS. General Post-Office, London. 1886.

Through the courtesy of Mr. C. H. B. Patey, Secretary at the General Post-Office, London, we are in possession of this volume, which has been printed for the use of the officers of the English telegraph service. The book is published in very handy form, and contains the diagrams of the various telegraph circuits on the different systems in use, comprising the single and double current, the automatic, and other systems. The telephone circuits are similarly treated, and testing instruments and directions for their use are also explained. The contents of the book must prove of great value to English telegraphers, and the idea might well be taken up by our large telegraph companies for the benefit of their employés, and to obtain uniformity in their systems of working.

LA TELEPHONIE EN BELGIQUE. By Charles Mourlon. Brussels, 1886.

M. Mourlon, so intimately connected with the development of electricity in France, has taken for his motto the sententious remark of Figuier, that people generally feel a secret humiliation in making daily use of an apparatus without knowing its nature and origin. In order, therefore, to help remove this feeling, the author describes popularly in detail the apparatus employed both at the subscriber's end and at the exchange, and gives the cost of the service and other information. Special attention is devoted, for examplification, to the telephone district of Mariemont-Bascoup, the exchange being operated by M.M. Mourlon & Co.

LA VERITE SUR LES EXPERIENCES DE CREIL. By E. Boistel, Paris. 1887. George Carré. 8¼ × 10¼ inches.

The report which a special commission made to the French Academy of Sciences on Marcel Deprez's experiments at Creil, and which was prepared by M. Maurice Lévy, has given rise to much controversy in France, and the opponents of M. Deprez have not yet ceased their attacks. The present *brochure* takes up M. Lévy's report, and by employing the "deadly parallel" column, attempts to show that the results obtained were not as set forth in the report, but on the contrary far inferior. For those interested in long distance power transmission, and especially according to the practice of M. Deprez, the work will make interesting reading.

Railway Accidents and the Means for their Prevention.

BY H. D. HALL.

An awful accident occured upon the Baltimore & Ohio Railroad, near Tiffin, Ohio, on Jan. 4, 1887, at 2:15 in the morning, at which hour it is generally very dark and difficult to perceive visual signals, and especially so at times of the year when foggy weather is apt to be prevalent. I gather, from perusing several different accounts, that this terrible disaster was caused probably as follows, it being remembered that this part of the road is a single track: The freight and express trains were approaching from opposite directions; the express was on time; the freight had ample time when it left its last station before the accident, namely, 55 minutes, in which to reach Republic, a station only four miles distant, where it would make a siding for the purpose of allowing the express to pass. Evidently, from all accounts, the freight engine became disabled, and proceeded at very much less than its normal rate of speed, which would usually enable it to reach Republic in ample time to make the siding. Before reaching Republic, however, the engine broke down entirely. It is evident that the conductor and the engineer of the freight train were aware of the fact that, on account of the delay caused by the disabling of the engine, they were encroaching upon the time of the express. It is also evident that the engineer and the conductor of the express had expected, of course, that the freight train was on the siding at Republic; but the engineer and the conductor of the freight train each calculated, as stated by them, that the express was usually behind time in reaching Republic, and, therefore, after the breaking down of the engine, they figured out that they would have plenty of time to signal the express, which undoubtedly they would have had under ordinary circumstances.

But there were no means of stopping the express train except by visual signals, and even supposing the express train *was* late, thereby giving the freight time to send signals, the night was perhaps foggy, which would have prevented the engineer seeing them, and the accident might nevertheless have happend without any negligence on the part of the employés on the freight train.

Now if the Phelps system of railway telegraphy had been in use on the Baltimore & Ohio Railroad at this time, in the first place, according to the method of using this system, the conductors of both trains would have known, within five minutes, of the relative positions occupied by each other, and also that of all trains upon the division. In the second place, the conductor of the freight train, as soon as he found that the engine was disabled and moving along at considerably less than the normal rate, rendering it liable that they should not be able to make the siding in time at Republic, could then, at once, by means of the Phelps railway telegraph system, have telegraphed to the Division Train Dispatcher the situation of affairs regarding his train, and the dispatcher could thereupon immediately have communicated with the conductor of the express train, telling him of the accident to the freight train; the latter could then have slowed up and been upon the look-out for the freight train (or signals from the latter).

Again, by means of the duplex feature of the Phelps system of railway telegraphy, the conductor of the express train could have telegraphed when leaving the last station, viz., from Chicago Junction at once to the station operator at Republic, and ascertained if the freight was on the siding; or, better still, he could have telegraphed to the freight conductor to know if the road was clear; or he could have telegraphed to the train dispatcher; all of which would have taken only very few moments.

But in all events, according to the method laid out for the use of the Phelps system of railway telegraphy in train dispatching upon single track roads, it would be the duty of all freight trains to telegraph to all advancing trains when they were side-tracked (all side tracks being "looped in" on the main line wire). All trains would thus be kept in constant telegraphic communication, and they would report their positions to the respective train dispatchers of each division every few minutes. I think it can be readily shown that if this system had been employed at this time upon the Baltimore & Ohio Railroad, the accident could not have occurred. It might be mentioned that the actual cost of this accident very likely would pay for the equipment of a great part, if not all, of the Baltimore & Ohio Railroad with the railway telegraph system referred to.

The Installation of Electric Light Plants.*

BY J. W. BEANE.

I have not examined these rules as carefully as I could wish, owing to a lack of time, but they appear to me to be in effect practically those which are pretty generally in use in this country at present. Referring to Rule II., at first thought it would seem better to limit the size of conductor by a certain excess of temperature above the air in which it is placed, say 56° Fahr., for the difference in temperature of a wire in winter and summer must make a difference in its carrying capacity, and I think this a proper subject for discussion. There is another matter which is well worth considering seriously, and that is whether it is not safer, at least in cases where low potential currents are used, to place the positive and negative leads close together, separated by a *thin* septum of some material of high insulating resistance, than the present method of using underwriters' wire and a half-inch septum of wood.

In regard to the inspection of electric light plants, as is well known, there is lack of uniformity in the requirements of the different boards of fire underwriters throughout the country, and as to their enforcement, in many cases it would seem as if no inspection was made at all, or at least in a very perfunctory manner. I regard the proper inspection of installations as of much value to the electric light companies, and believe that no plant, no matter where located, nor how small, should escape.

This matter of *uniformity* in the rules of the boards of fire underwriters, and, what is more important, their impartial, rigid enforcement, is one which should claim the attention, and calls for the united action of the electric light and power companies.

I refer here simply to the necessity of *more uniformity* in the rules enforced in different parts of the country, and do not wish to be understood as indorsing any of the wild statements I have seen published in some of the daily journals recently setting forth the terrible havoc of the electric light, both as to property and life. It is hardly worth while to treat these assertions seriously—the time has gone by when it would be necessary to do so—to set the matter in its proper light before the public. As to the dangers from fire, I have only a word or two to say—the losses from fire in this vicinity during the past five years have amounted to a value of twenty-five millions of dollars ($25,000,000)—during the same period, and in the same territory, the losses due to electric light currents have reached the *enormous* (?) value of four thousand dollars ($4,000), and there are more electric lights here than in any territory of equal size in the country.

To show you how exclusive a lien the authors of these statements referred to have upon this made-to-order-fire-fiend of the electric light, I will call your attention to the fact, which is well known to you all, that fire insurance companies in New England and in and around New York make a reduction, in a large number of risks, in the rates of insurance where the electric light is installed instead of other illuminants.

As to the terrible loss of life, the entire number of deaths from high tension electric light currents since lighting by electricity has become a commercial occupation can be counted on the fingers of the hands. Let us consider other illuminants, oil or gas; the merest tyro cannot fail to see the absurdity of the comparison as in favor of the electric light. Let us bring the matter right home to New York, and we find that the Coroners' reports for four or five years past record deaths due to gas (excluding suicides) numbering at least twenty (20) per annum. If we consider the fatalities among engineers, machinists, miners, carpenters, painters, masons, etc., the comparison becomes most marked in favor of the electrical engineer. It is not my desire to belittle the dangers of high tension currents, but I must protest against their exaggeration. With the safeguards that are now employed in their manipulation, the possibility of fatal shocks are indeed few, but as to making the occupation of electrical engineer an *absolutely* safe one, we might as well attempt to make existence absolutely safe from fatal accident. Of course the old saw-mill admonition in relation to undue familiarity with the buzz-saw while in motion applies, in principle, equally well in the central electric light station.

Mr. De Camp: It is very unfortunate that Mr. Beane is not here, but, at the same time, I think he said just about all that could be said on that subject. He states the facts. People may say to me that I may drop down dead or may be struck by lightning to-morrow; but I have lived some forty-five years and have not been struck by lightning. Therefore, I do not let that thing worry me. The thing of greatest importance that I see in connection with this is the excitement of the insurance interests on this point. I think that I would feel just the same way. In the matter of electric lighting, they are insuring against a risk of which they really know nothing, and, like all of us, they are prepared to give themselves the benefit of the doubt.

* Abstract of paper read before the Electric Club, Jan. 6, 1887, reference being made to a set of proposed rules prepared by Dr. G. H. Benjamin.

Recently, in Philadelphia, without any known cause, they have advanced, or attempted to advance, the rates from three-quarters to one and one-quarter per cent., for no other reason than the fact that the station is an electric light station. They cannot for the life of you give any other reason if they are pressed to the point. But I suppose they say these people cannot do without insurance. If they cannot get it at three-quarters, they will have to pay one and one-quarter. So far as our company is concerned, I do not think that we have had the first blaze from fire from the electric current, and we have not had one accident in our electrical department. where we have had five in our mechanical department.

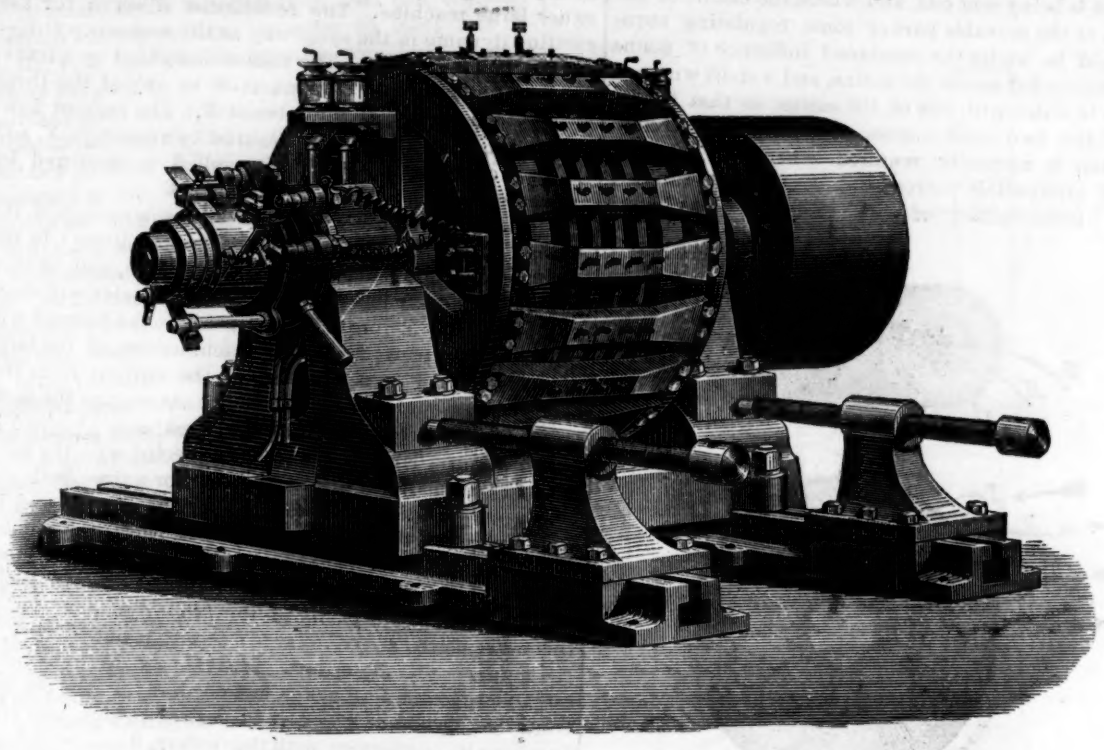


FIG. 1.—ZIPERNOWSKI-DERI ALTERNATING CURRENT DYNAMO.

Central Station Lighting by Zipernowski Transformers.

In view of the great present interest in this country in "transformers," the continued successful operation of the central stations in Europe employing secondary generators or transformers on the Zipernowski-Deri-Blathy system, makes it of interest to examine into the equipment of a central station and the manner of running circuits on this method. The central station at Rome, now in course of completion, has been undertaken by the Roman Gas Company. The installation is designed for 18,000 incandescent lamps, 1,800 of which are already in operation. The station is at the works of the said company in the Circo Massimo, and the following are among the larger buildings which are to be supplied with electric light: Houses of Parliament with 1,200 lamps; Theatre Argentina, with 2,000; Senate, with 600; Theatre Paise, with 300; Tir National, with 230; Theatre National, with 400; Quirinal, with 800; Ministry of the Interior, with 180; Palazo Huffer, with 200.

Examining first the transformers employed in the system, it may be stated as a generality, that in order to increase the efficiency of an induction apparatus, the effects of induction must be strengthened as much as possible. This is done, first, by causing the changes of current to take place rapidly; secondly, by bringing into the closest possible proximity the inducing (primary) and induced (secondary) wires; and finally, by enlarging the cross section of the mass of iron which is surrounded by the wire coils. The number of current reversals varies in different dynamos; but Messrs. Zipernowski & Déri have found, they state, that from 80 to 120 reversals per second are sufficient in every case. The most appropriate means of increasing the yield of transformers consists in perfecting their magnetic circuit. If we should attempt to increase the yield of the transformers simply by bringing the primary and secondary coils nearer to each other, we should soon reach the limit beyond which further improvement in that direction becomes impossible. But we can, on the other hand, effect a far greater increase of the yield by enlarging the cross section of the iron core. The apparatus should be constructed in such a manner as to prevent any dispersion of the magnetic lines of force, and to place all the turns of the coils through which the currents flow, as it were, in a homogeneous magnetic atmosphere. The action of induction will, in that case, be the same on each particle of the copper wire, and the whole length of wire will be utilized. These advantages are aimed at in the Zipernowski transformers. The fundamental form, shown in plan and section in Fig. 3, is a circular magnet, which is wound in such a manner that no poles can be formed in it. The core consists of a bundle of iron wires, surrounded by the primary and secondary coils. In another modification, as shown in plan and section in Fig. 4, the iron and copper have changed places. The core consists of insulated copper wires, constituting the primary and secondary coils, which are formed into a ring, and are then wound round with an insulating covering consisting of linen soaked in varnish, and finely wound closely round with thin insulated iron wires. The currents in the copper wires and the lines of force in the iron wires circulate in such a manner that both circuits form planes perpendicular to each other. The iron wires form, to a certain extent, a protective covering for the copper wires, whose ends pass through a gap in that covering as shown in Fig. 5. The iron wires are either covered with cotton or coated with varnish. The iron part forms a closed magnetic circuit, and each particle of the copper conductors is surrounded by an equal number of iron wires, and, consequently, also by an equal number of lines of force. The extremely powerful action of such electro-magnets is evident, and the transformation is effected with great efficiency by the induction between comparatively small masses. In consequence of the arrangement of the active iron, only a small quantity of current is required to magnetize the masses of iron. From 1 to 2 per cent. of the electrical energy is generally sufficient for that purpose, whilst the consumption of energy by the resistance of the coils is said to amount only to 1 per cent. of the total yield.

Without entering into the mathematical theory of transformers, we may take it for granted that for all systems, if the resistances of primary and secondary coils may be neglected, the following statements hold good: (1) The difference of potential between the primary terminals is always proportionate to the difference of potential between the secondary terminals. (2) The proportion between the E. M. F. at the primary and the secondary terminals is constant, and equal to the so-called co-efficient of conversion of the transformer. The fundamental condition of the Zipernowski system is that the difference of potential of the primary current at the terminals of the transformer, or of the group of transformers, shall remain constant, although the quantities of current in the respective circuits may vary continually. This arrangement resembles the action of the compound dynamos between whose terminals a constant E. M. F. or pressure is maintained, when single lamps are either cut out or switched in. It is far more difficult when using alternating currents, especially at high pressure, to arrange for the latter remaining constant at a distance of several miles from the dynamo machine, and herein lies the very gist of the system. The problem has been solved in the following manner: It is well known that, given a constant speed of the dynamo, its E. M. F. remains constant, provided the magnetization is uniform. With the increase of current, however, the E. M. F. is lowered, a result consequent on an increased loss of E. M. F. due to resistance and self-induction. If we now desire to maintain a constant difference of potential at different points of the circuit, we must render the E. M. F. of the dynamo, even when it is running at a constant speed, variable in the opposite sense. We cannot then have a constant magnetic field, but one which grows in the same sense as the primary current. For this purpose Mr. Zipernowski introduces in the

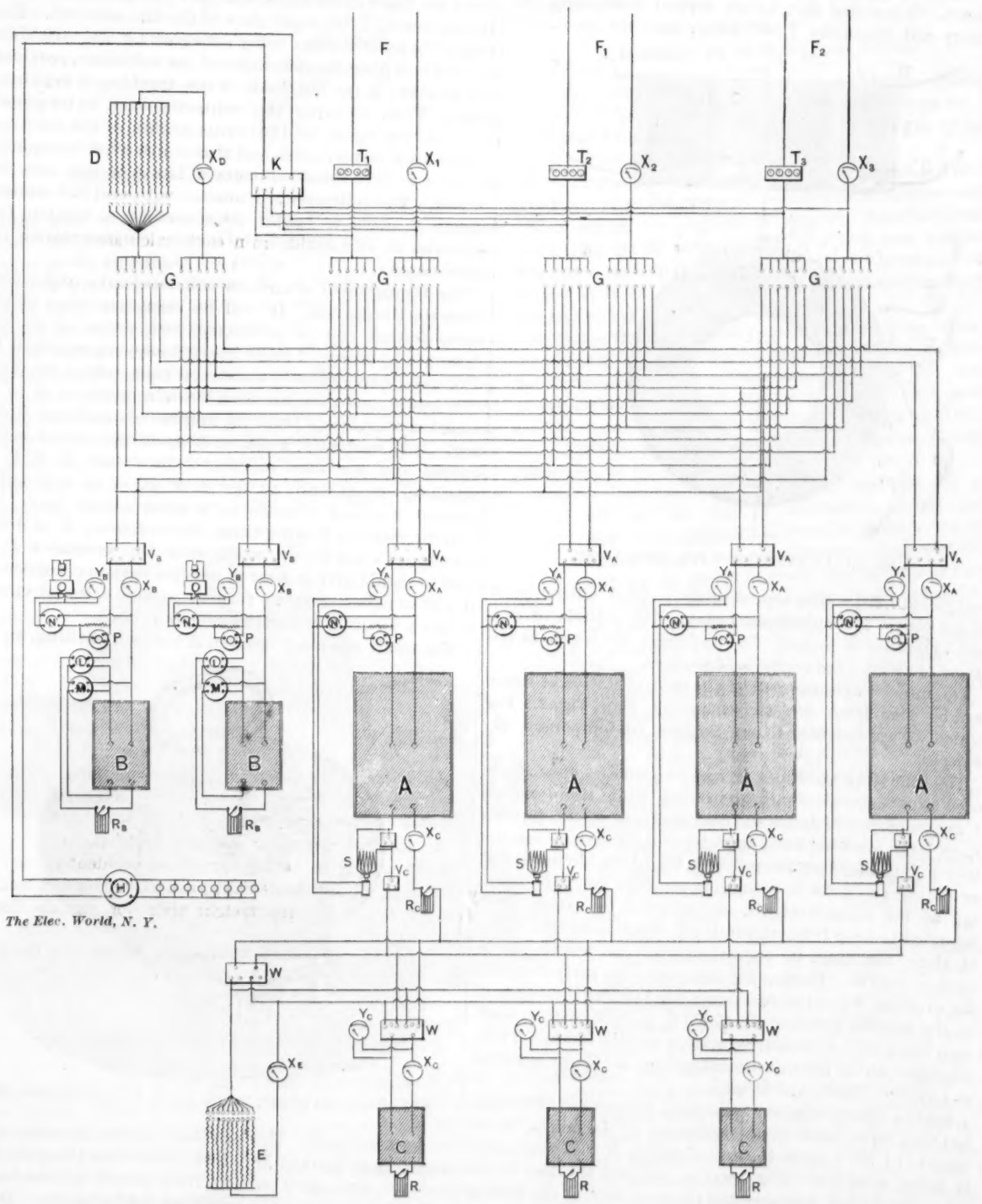


FIG. 2.—GENERAL ARRANGEMENT OF ZIPERNOWSKI-DERI CENTRAL STATION, AT ROME.

exciting circuit a second source of current, whose E. M. F. is added to that of the original exciting circuit. This second E. M. F. is not constant, but is dependent on the principal current, and as near as possible proportional to it. This regulating E. M. F. is produced by a small transformer, called a compensator, which is placed near the generating dynamo, and as shown diagrammatically in Fig. 6. It has two coils, through one of which the principal current flows, whilst the other is connected with the exciting circuit.

The self-exciting alternate machine of Messrs. Ganz & Co., which is represented in Fig. 1, is designed for this sort of regulation. It is a machine with eighteen magnet poles, and yields from 50,000 to 60,000 watts. In these machines the magnets rotate, whilst the armature is fixed, and the current is led off from fixed terminals. The commutator serves to reverse a small portion of the induced current, so as to use it for exciting the magnets. In the latter circuit the secondary spiral of the compensator is introduced in such a manner that its E. M. F. is added to that of the exciting circuit, in the same proportion as the strength of the principal current grows; that is, as the number of lamps in use increases. Thus, without the medium of variable resistances, or of any mechanism, a constant difference of potential and a constant brilliancy of the lamps is maintained.

The usual type of transformer is constructed for 7,200 watts, and has the following resistances: In primary coil, 1.15 ohm; in the secondary coil, .0045 ohm. The primary current for producing the above output is 8.25 ampères; loss through resistance = 8.25×1.15, or about 10 volts, whilst 918 volts are required to overcome the counter E. M. F. generated by 100 reversals per second. If the secondary circuit is open, the primary current is .32 ampère, and a continuous current would, therefore, have an E. M. F. = $.32 \times 1.15 = .37$ volt, whilst the alternating current requires 900 volts, or an E. M. F. 2,400 times as large. It is stated that, under normal conditions, the primary coil consumes 7,560 watts, and the secondary

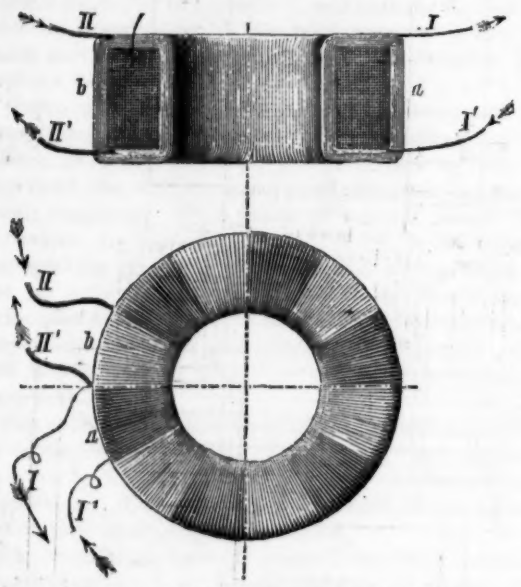


FIG. 3.—CONVERTER WITH IRON CORE.

coil yields 7,200 watts, representing a total efficiency of 95 per cent. The apparatus contains 180 pounds of iron and 75 pounds of copper. In the former 210 watts, in the latter 140 watts, are converted into heat.

The interior arrangement of the central station at Rome will be seen from the accompanying plan, Fig. 2. For which we are indebted to our English contemporary, *Industries*.

The four large machines *A*, and two smaller ones *B*, are used to generate alternating currents, while the dynamos *C* are employed to excite the field magnets of the former. Each large machine has a capacity of 4,000 sixteen candle-power incandescent lamps, and is driven direct at 125 revolutions by a 600 h. p. engine, the field magnets forming at the same time the fly wheel of the latter. It is intended to keep from nightfall till about midnight three of these machines in operation, while the fourth will be used as reserve. During daytime, or in the early hours of the evening, when but few lamps are burning, one or both of the smaller dynamos *B*, of 150 h. p. each, will be used, each being able to feed 1,000 sixteen candle lamps. These machines are of the same construction as those installed at Luzerne, Turin, and Milan.

All the dynamos give a maximum pressure of 1950 volts; but this, on account of the resistance of the mains, is reduced to 1,750 volts at the transformers if the maximum is being sent out. For smaller currents the loss is proportionately less, and then the pressure kept at the station is somewhat below 1,950 volts. In all cases the pressure at the central station is so regulated that 1,750 volts are maintained in the network of mains to which the different transformers are connected.

To equalize as much as possible the pressure in the main network, three feeders *F*, F_1, F_2 are used, tapping the mains at three different places. Since it would be inconvenient to lay separate service wires to bring back to the central station the indication of the pressure at the transformers, a differential device is employed, whereby the voltmeters marked *Y* indicate, not the pressure at the terminals of the dynamo, but at the junction between the feeders and mains. This device is similar in principle to that which would be used in regulating the pressure where a continuous current is being sent out, and where the needle of the voltmeter, or the movable part of some regulating apparatus, would be under the combined influence of a fine wire coil connected across the mains, and a stout wire coil connected in series with one of the mains, so that the influence of the two coils oppose each other. A certain modification is naturally required where we have to deal with alternating currents; but, without entering into the technicalities of the case, we may men-

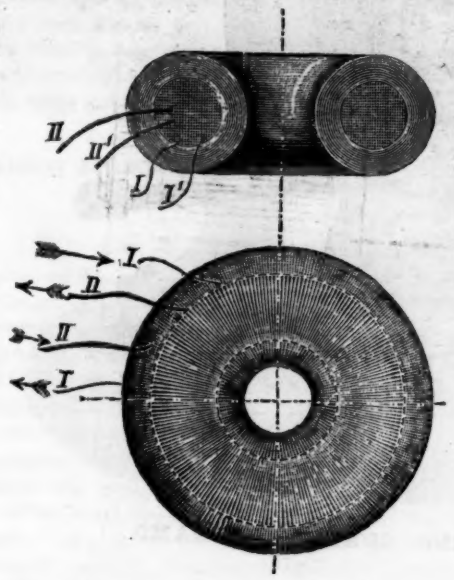


FIG. 4.—CONVERTER WITH IRON JACKET.

tion that the apparatus marked *P* in the illustration takes the place of the thick wire coil just described, whilst the apparatus *N* takes the place of the fine wire coil. The larger the main current being delivered by the machine, the lower will be the indication of the voltmeter, provided the pressure at the terminals of the machine is kept constant. Now, to bring the voltmeter back to its proper position, the speed of the steam engine or the exciting power must be increased, and that is just what is required in order to have equal brilliancy of lamps on the external circuit. The voltmeter is connected with oral and audible signals *Q*, so as to enable the attendants to regulate the pressure at the station in accordance with external requirements.

The arrangement of circuits will be clearly understood from the illustration. It will be seen that either of the three feeders can be connected with either of the six dynamos by means of plugs inserted between terminals *G*. The coils *D* are ordinary resistance coils taking the place of a feeder, and these are used when a machine is to be added or withdrawn from the number of machines working. It is, evidently, a matter of great importance not to couple any machines together before their E. M. F. is absolutely equal, and, as the E. M. F. of an alternating current machine depends to a great extent upon the current which is flowing from that machine, it is necessary to set a machine to work upon the resistance *D*, so that it should give as near as possible the same current as it will be called upon to furnish to the external circuit before a junction is actually effected.

The small machines marked *B* are self-exciting, as al-

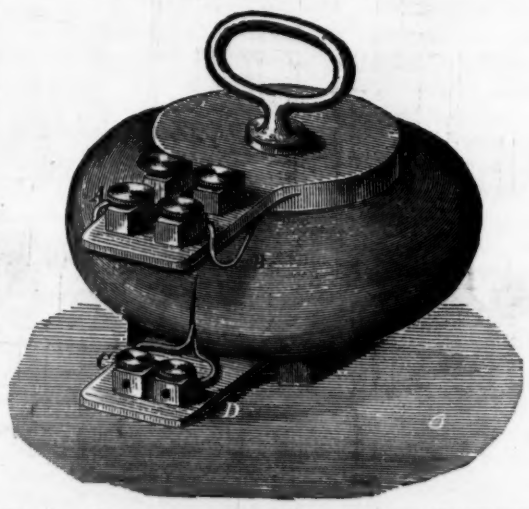


FIG. 5.—CONVERTER WITH IRON JACKET COMPLETE.

ready mentioned. The exciting current is supplied by a transformer marked *M*, which is fed from the main leads, and the secondary current from which is commutated before being sent in the revolving field magnets. The increase of exciting current, necessitated by an increase of external current, is produced by a second transformer marked *L*, the secondary coil of which is in series with that of the transformer *M*. To a great extent, therefore, the smaller dynamos effect the increase of external pressure at larger outputs automatically; but to provide for a finer adjustment by hand, rheostats R_b have been added. In a similar manner, the rheostat R_c serves to regulate the exciting current of the large dynamos. The apparatus *Q* is an alarm bell and visible signal, which begins to ring whenever the pressure outside is either above or below the normal. The arrangement of circuits from the exciting machines to the four large dynamos is such that either dynamo may be used to excite either large machine. The resistances *E* serve for the exciting dynamo in the same way as the resistance *D* does for the large dynamo. The station is lighted by a transformer *H*, which can be connected to any of the three feeders by means of a switch-board *K*. The current flowing through any feeder is measured by ammeters *X*, and the total quantity of electricity supplied is measured by ammeters *T*.

When the full number of lamps will be in operation, the manner of working the station will be as follows: In the day time only one machine *B* will be worked, and, as soon as the demand for light increases, the ammeter will show this, and a little before it is expected that the demand will reach the full capacity of this machine, one of the large machines *A* will be set in motion, the current from this being sent through the resistance *D*. As soon as the same pressure and current has been reached as is obtained in dynamo *B*, the large dynamo is connected with the feeders, and the small one disconnected. For a time, both machines are working in parallel; but, as was proved by Dr. Hopkinson, there is no difficulty in this if the number of reversals in both machines is approximately the same. Later in the evening, the total current sent out will gradually approach the capacity of the large dynamo. Before this takes place, a second large dynamo is put to work, in the manner just described. If dynamos are to be taken off, the rheostat *D* is again switched in to take the load from that dynamo which it is desired to stop, and after breaking its connection with the feeders, it can be brought to rest gradually. It will be noticed that the system of conductors in the station is exceedingly complete, and affords every facility for separately testing.

Motors for Electric Lighting.

The Council of the London Society of Arts are prepared to award two gold medals and four silver medals for prime

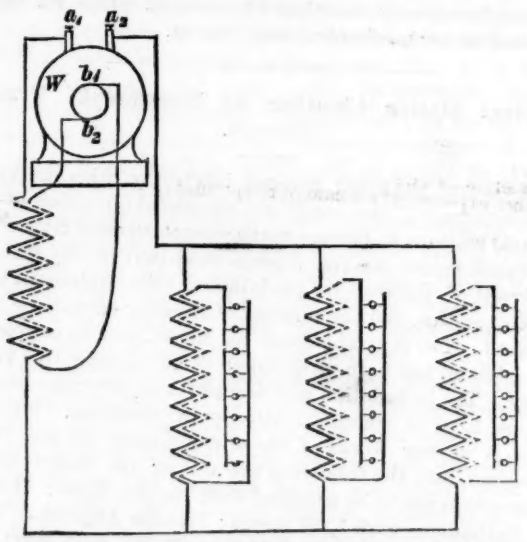


FIG. 6.—DIAGRAM OF COMPENSATOR IN CIRCUIT.

movers suitable for electric light installations. The medals will be awarded on the results of practical tests, the conditions for which are as follow: The motors will be divided into two classes, A and B. One gold and two silver medals will be awarded in each class.

(A) MOTORS IN WHICH THE WORKING AGENT IS ALSO PRODUCED.—*Steam:* Ordinary portable or semi-portable non-condensing engines; ordinary portable or semi-portable condensing engines. *Gas:* Coal gas or water gas, with producer; petroleum vapor; liquid petroleum.

(B) MOTORS TO WHICH THE WORKING AGENT MUST BE SUPPLIED.—*Steam:* Detached engines, non-condensing, without boilers; detached engines, condensing, without boilers. *Gas:* Engines worked by illuminating or other gas; engines worked by raw gas without producers. *Hydraulic:* Water motors.

Each class will be subdivided into two groups—those declared to develop not more than 10 h. p., and those which will develop more than 10 h. p. and less than 20 h. p. The entrance fee will be £2 10s. per h. p., to be paid on entry. No competition will be held unless at least ten motors are entered. In case of no competition being held, the entrance fee will be returned. The Council reserves the right of refusing any entry. All engines and boilers must be fitted up in accordance with the regulations of the Royal Agricultural Society. The points of merit considered of the greatest importance are: (*a*) Regularity of speed as to revolutions per minute under varying loads; (*b*) Regularity of speed during the various parts of one revolution; (*c*) Power of automatically varying speed to suit arc lights; (*d*) Noiselessness; (*e*) First cost; (*f*) Cost of running; (*g*) Cost of maintenance. The tests will be carried out under the direction of three judges, appointed by the Council of the Society of Arts, who will report to the Council, and will confer with them on the awards. All costs of fitting up and working the motors must be borne by the exhibitor. The society will provide the brakes, indicators and apparatus, electrical and other, necessary for making the tests. The Council reserves the

fight of withholding any or all the medals. The competition will take place in London about May or June next. Entries must be sent in by Feb. 28, 1887.

A New Sprague Motor.

While, heretofore, electric motors of but a few horse-power have been called for, the users of larger powers are becoming aware of the fact that they also can economically employ electric motors. In order to meet this demand, Mr. F. J. Sprague has recently completed designs for motors ranging up to 20 h. p., and several of these have already gone into operation.

The accompanying illustration shows the general design of these new motors; the one illustrated being of 15 h. p. It is designed to run at 220 volts and at a speed of 1,200 revolutions per minute. Tests made with the machine show it to have an armature efficiency of 96½ per cent., and a total commercial efficiency of 91 per cent. at full power. As an instance of the steadiness of motion of the machine while in operation, it may be stated that our engraving was made from a photograph of the machine taken while the latter was working at full speed, and during an exposure of several minutes.

A handsome catalogue recently issued by the Sprague Electric Railway and Motor Company sets forth the uses to which the motor can be put, and gives a complete list of several hundred motors manufactured by them and their present location. The exhibit of results is a most admirable one, and interesting, and users of power as well as those concerned in increasing the revenue of central electric lighting stations will find much to merit their attention in the publication. The testimonials from present users are, really, most striking.

As an estimate of the cost of supplying electric power from a central station already established, and the profits therefrom; we give below the figures stated to be founded upon actual practice with the Sprague system. It is assumed that the station is in running order, and furnishing lights for both day and night service, and that its capacity is 150 h. p. Owing to the well-known intermittent use of power by consumers, it may be safely assumed that 50 per cent. above the actual output of the engine can be sold. According to this estimate, then, the following figures are given:

INVESTMENT.	
Additional wires, structures and switches	$2,500
RUNNING EXPENSES.	
Coal (cheap fuel, three tons screenings to one ton Cumberland), four pounds per horse-power per hour, ten hours per day	$2,200
Oil, additional	100
Motor inspector (can also attend to lamp inspection)	500
Water, incidentals, etc.	200
Other expenses which cannot be specified	500
Total	$3,500
PROFITS.	
Income from 225 horse-power at $125 per horse-power per annum	$28,125
Less expenses	3,500
Profits	$24,625
Income from 225 horse-power at $100 per annum	22,500
Less expenses, per annum	3,500
Profits	$19,000

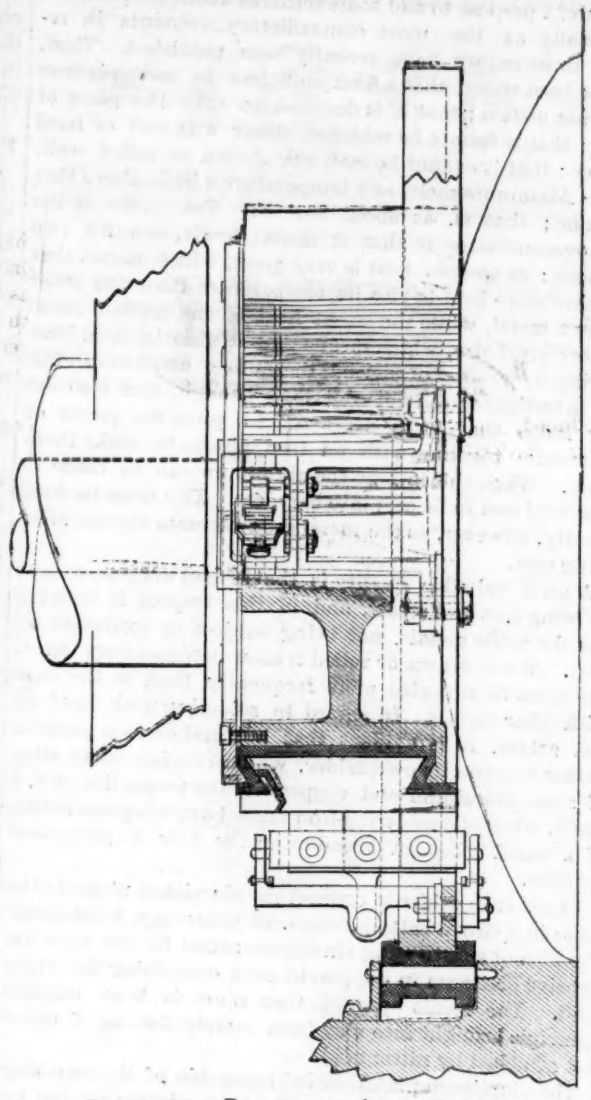
"Where the station is only running during the night, the profits are the same as above, after first deducting the additional expense for engineer and fireman for day service, but as all incandescent plants to be a complete success must be run during the day, and as such has been the experience of so many plants, it hardly needs mention, and the additional profit from the day lighting will, in almost every instance, more than cover the extra expense."

Electric Street Cars for Fulton Street, New York.

In the course of an interview last week with a reporter of the *Commercial Advertiser*, Mr. E. M. Bentley, of the Bentley-Knight Electric Railway Company, said: "We are already at work on the electric motors for the Fulton street line. There will be a maximum of twenty cars run at first, for although the road is not more than a mile in length, we anticipate a heavy traffic, especially while it is a novelty. We shall use two 100 horse-power steam engines for operating the road, with a third engine of the same power for a reserve. This, you see, is an allowance of 10 horse-power per car, which is more than sufficient for ordinary running, but we might need it all in an emergency. In good weather one engine could do the work, if speeded up a little. A steam engine and a dynamo can both be made to do a much greater amount of work than their nominal rating, although they have not the same economy when hard pressed. An electric motor also has a greater range of power than is usually supposed, and this is why it is especially adapted for street-car work. With plenty of power at the steam engine its strength is practically irresistible, being limited only by the magnetic saturation of the iron or the burning of the motor. A few days ago we had sixty-five men on our cars in Providence, R. I., and the brakes down hard, yet it went around a sharp curve and up a grade of one in twenty at a fair speed. An indicator card taken from the engine at the same time showed that nearly 40 horse-power were absorbed. Of course, a motor will stand only a limited amount of such abuse, probably not more than two hours of it; but it shows what it will do in an emergency."

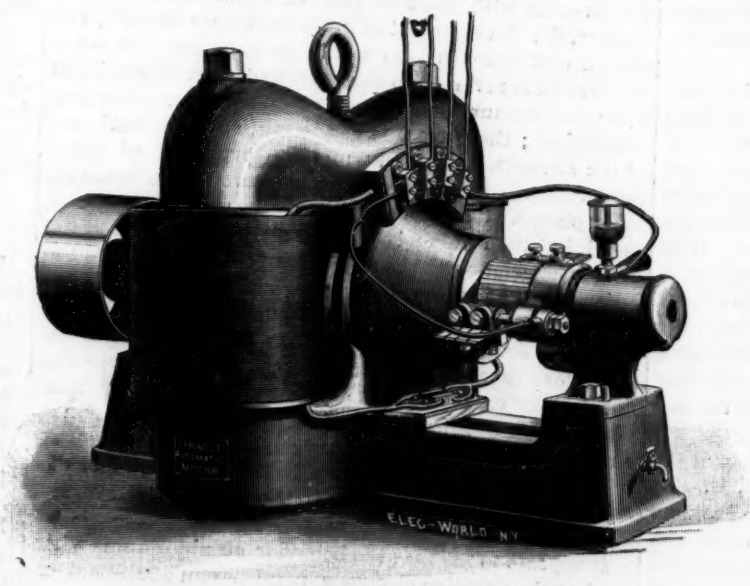
"Is not the first cost of an electric road very great?" asked the reporter.

"It costs more than a horse railroad, but much less than a cable road," replied Mr. Bentley. "The conduit



REGULATING BRUSHES OF FIELD MOTOR.

is the most expensive item. Our conduit, extra heavy, costs $20,000 per mile. The cheapest cable conduit, as given in the circular of the National Cable Railway Company, is $56,000 per mile, and Mr. Holmes, of the Chicago cable road, is quoted in the circular as saying that his conduit cost $105,000 per mile. It is safe to say that a cable conduit costs twice as much as ours, while the rest of the equipment costs about the same. As to running expenses, we are also ahead of the cables. We get 50 per cent. of our steam engine power to our car axles, while only 18 per cent. is claimed for a cable; but this saving in the coal bill is not so important as the saving in the interest on the first cost of the plant. In a long road, the interest charge becomes much the greatest of running



NEW 15 H. P. SPRAGUE MOTOR.

expenses, and it is fully twice as much for a cable as for us. Then a cable road has, in addition, to pay for renewing the cable every few months, and has to oil and repair a great number of pulleys along its line.

"Besides cheapness, we have several important advantages over a cable road. We have no mechanism along the line to attend to. The curves, switchings, crossings, turntables and branches, all of which in a cable road necessitate a great complication of wheels, pulleys and pits, are in an electric system exceedingly simple—no more complicated, in fact, than a horse road. This is of great importance where a main line has a number of branches or feeders, and when one line uses the tracks of another line for a distance, as is the case in every city. We can also extend a line without difficulty, as occasion may require."

"You speak with a good deal of confidence of your system; have you had any practical experience with it?"

"The development of this electric railway has been almost the sole occupation of Mr. Knight and myself for nearly four years. Our first road was a short one, in the yard of the Brush Electric Company, at Cleveland, Ohio, and was built in the winter of 1883–84. Gaining experience with this road, we went into the street, using about two miles of the track of the East Cleveland Railway Company. We operated that road for over a year, and with great success, considering that we encountered there nearly every difficulty known to street railroading. Our conduit was of wood, and not strong enough for the permanent wear of the street. The roadbed was old and dilapidated, and the street had no sewer or drainage, yet we managed to carry on a large part of the business of the road until the fall of 1885, when, as the street was about to be torn up for a sewer, we went to the Rhode Island Locomotive Works, at Providence, to prepare for manufacturing on a large scale. The engineers at the locomotive works have supervised the mechanical details of the motor trucks, and the construction is now entirely in their hands."

The Field Method of Motor Regulation.

To the Editor of The Electrical World:

SIR: My attention has been called to a communication in THE ELECTRICAL WORLD of Jan. 1, from Mr. S. S. Wheeler, regarding my motor brush-regulator (see cut).

Reference to the article describing the arrangement in THE WORLD of Nov. 6, 1886, will show that connection between the extra brushes and commutator only occurs as every fifth plate passes, all others being insulated. Consequently no short circuiting of the commutator plates can ensue. Connection between the two extra brushes is accomplished through a very high resistance circuit. In no case would the current passing this route be more than 0.05 ampère, an amount so small that its sparking effect is not appreciable.

STEPHEN D. FIELD.

YONKERS, N. Y.

A Decision as to Telephone Poles.

The following is the full decision by Judge Rumsey, delivered at Rochester, N. Y., on December 30, as to the injunction sought by the telephone company, to prevent the city from removing a pole:

It is necessary to state only the conclusions which I have reached as the result of the discussion on this motion.

First.—That the plaintiff is properly organized under chapter 265 of the laws of 1848 and the acts amending that law. Attorney General *vs.* Edison Telephone Company, 6 Q. B. D., 244; Wisconsin Telephone Company *vs.* City of Oshkosh, 62 Wis., 32.

Second.—That under the powers conferred by that act, the plaintiff acquired the privilege of erecting its poles in the streets of the city of Rochester without the consent of the authorities of said city, providing the said posts do not incommode the public use of said streets. 2 R. S., 7th ed., 1720, Sec. 5: Weed *vs.* Atlantic & Pacific Telegraph Company, 71 N. Y., 81.

Third.—That the so called contract between the plaintiff and the city of Rochester, giving permission to the plaintiff to erect its poles in the streets of the city, is not effective as a grant, because the city has no power to grant the right to any person to maintain a permanent obstruction in the streets. Ely *vs.* Campbell, 59 How. Pr., 333.

Fourth.—That if valid at all, it was merely a license and revocable at any time, and that the subsequent resolution was a revocation, so far at least as to poles sought to be subsequently erected. St. Vincent Female Orphan Asylum *vs.* City of Troy, 76 N. Y., 108; Babcock *vs.* Utter, 1 Abb. Ct. of App., Dec. 27. But the abrogation of such license did not affect the right which the plantiff acquired by the statute above cited.

Fifth.—The act threatened to be done by defendants being a mere trespass cannot be restrained unless it will cause irreparable injury to the plaintiff. Livingston *vs.* Livingston, 6 John C. H. 497; 1 High on Ju. J. Sec. 701.

Sixth.—That upon all the papers it does not appear that the removal of this pole will work an irreparable injury to the plaintiff as to its business. I do not decide whether or not the pole placed as it is incommodes the public use of the highway. The affidavits presented by the defendants tend strongly to show that, in view of the situation of the pole and its surroundings and the obstructions which had previously been placed in the street in that vicinity, the public use of the highway may, to some extent, be incommoded. If that be so the pole should not stand there, and the defendants would not be trespassers if they removed it. But I do not think that question is here. Upon the whole case, as presented by the papers, it seems clear that the threatened removal of the pole will cause no more than a temporary inconvenience to the plaintiff, and that a case is not made for the interference of a court of equity.

The Production of Aluminum, with Special Reference to the Electrical Method.*

BY DR. P. H. VANDER WEYDE.

My early experiments in the deposition of metals from solutions by electrolysis, dating back as far as 1888, led me naturally to attempt also the separation of aluminum from its soluble salts, but without success. I succeeded in depositing zinc in this way, but not from the sulphate solutions, like copper, but from a solution of the oxide of zinc in caustic soda; and I foresaw confidently that the success which would finally crown the attempts to reduce aluminum by electrolysis would lie in a similar direction, namely, in the use of the chloride of aluminum and chloride of sodium, acted upon by a current sufficiently strong to overcome the resistance in a mass not liquified as an aqueous solution, but liquified by heat.

In order to understand this, it may well to go back many years and mention first the discovery of Oersted, of Copenhagen, half a century ago, viz., that the oxide of aluminum or pure porcelain clay can be compelled to give up its oxygen by the aid of the strong affinity at a red heat of oxygen for carbon, provided we give the aluminum another element to combine with in exchange for the oxygen. It is known that in the case of iron this is not necessary; all we have to do is to mix the iron with the coal and apply heat, so as to accomplish the reduction of the metal. But aluminum cannot be reduced in this way, its affinity being too strong. If, however, we pass chlorine gas through a mixture of pulverized carbon and alumina, the result will be that besides carbonic oxide, chloride of aluminum will be formed, which is also volatile but may be condensed and preserved in glass-stoppered bottles.

This old process was patented in England some thirteen years ago by Garneri, who describes in detail the Oersted method without giving credit to this early investigator, and then goes on to say that the aluminum may be reduced from its chloride by means of the operation of a magneto-electric apparatus.

It is only quite recently that the last hint has been applied, and the current of a powerful dynamo used for the purpose intended, to which I will refer presently, after having exposed the still prevailing error that the production of cheap aluminum depends upon the production of cheap sodium.

It was very natural to make use of the strong affinity of potassium for chlorine, which was the first method employed to subtract the chlorine from the chloride of aluminum; this was applied by Woehler; he heated the mixture of both substances and obtained aluminum in the condition of a powder.

Deville, who has become famous by his investigations in this line, substituted sodium for the potassium, and, heating the mixture in an atmosphere of hydrogen gas, so as to prevent the combustion of the sodium, he thus obtained reduced metallic aluminum, and chloride of sodium or common salt.

It is now thirty years ago that Percy made aluminum from cryolite in a similar way, namely from a mixture of cryolite, common salt and sodium (cryolite being a fluoride of aluminum and sodium), which he heated in a closed crucible. As cryolite is always contaminated with silicates, however, the aluminum thus obtained contains much silicon, is not white, and very inferior to that obtained from clay.

Those chemists who anticipated the function which electricity was destined to play in metallurgy, and realized the small chance there was to obtain cheap sodium, directed their attention in another channel, which, however, resulted in no practical success as long as very large galvanic batteries were required to furnish sufficiently strong currents to effect the separation desired. They used a mixture of chloride of aluminum and common salt, and heated it in a porcelain crucible to 390° Fahrenheit. When the mass had become liquefied by the heat, the electrodes of the battery were introduced, consisting in a platinum plate and a carbon cylinder; the platinum plate received the deposit of aluminum, while the chlorine escaped at the carbon pole.

This is essentially the process now in operation at the establishment of Messrs. Cowles, of Cleveland, O., and now at Lockport, N. Y., with the exception that they use powerful dynamo currents to effect the reduction, producing a current strong enough to keep up the heat required without needing any additional heat under the fire-proof crucibles in which the operation takes place.

One of their special productions is aluminum bronze, an alloy which is sold for various prices, depending on the quantity of aluminum present; being rated at $5 per pound in the alloys. Pure aluminum, however, cannot yet be obtained at that price, but costs about five times as much. There is no doubt that the increasing demand for so beautiful and useful a metal will stimulate production and thus lower the price. This at least appears to be the law for all cases of this nature, and if we consider the abundance and cheapness of the ore, the price will depend alone on the methods of production. Pure alumina Al_2O_3 can be produced for 7 cents per pound, which, as it contains 55 per cent. of aluminum, makes the cost of the latter scarcely 14 cents. This admits of a large margin for cost of production, if we consider that a metal of such valuable qualities ought to be worth at least as much as nickel.

As a correct and reliable description of its qualities is of more general interest than details in the process of manufacture, I propose to add some remarks about its qualities, especially as the most contradictory accounts in regard to its nature have recently been published. Thus, it has been stated that a heat sufficient to melt pig-iron will not melt it; that it is destined to take the place of iron; that it cannot be soldered, either with soft or hard solder; that it cannot be cast, nor drawn or rolled well, etc. Aluminum melts at a temperature a little above that of zinc; that is, at about 800° F. The cause of the old overestimates is that it melts slowly, and for two reasons: its specific heat is very great, which means that it takes more heat to rise its temperature than any other known metal, while the latent heat of the melted metal is very great also, which means that it absorbs more heat during the process of melting than other metals do. The old investigators did not wait long enough, and also did not know that it is necessary to press the pieces of aluminum together with an iron piston to make them unite. When this is done the aluminum can be made to flow well and to be cast into bars, etc. This must be done rapidly, however, as the metal soon becomes viscous after being cast.

A most valuable quality is that it does not lose weight by being cast and recast, and in this respect it behaves like the noble metals, not being subject to oxidation by heat. When drawn or rolled it soon becomes very hard, and must be annealed more frequently than is the case with other metals. In regard to soldering with hard or soft solder, it is evident that a metal of such peculiar nature requires its own solder, which consists of an alloy of zinc, aluminum and copper, in the proportion of 5, 3 and 2, while the soldering-iron must have a top consisting of a small block of aluminum; the flux is pulverized cryolite.

I used such solder to connect the aluminum plates to the zincs in a Grove battery, when, 25 years ago, I conceived the idea of substituting aluminum plates for the more expensive platinum in the porous cells containing the nitric acid. The result proved that there is here another principle brought into play than merely having a metal not attacked by nitric acid.

The aluminum plates proved incapable of decomposing the nitric acid, as is the case with platinum; the arrangement was nearly inert, and I abandoned it. This might have been foreseen, as aluminum belongs to the other end of the series given by Berzelius, of the positive and negative elements; carbon, platinum, silver, etc., being negative, while potassium, aluminum and zinc are positive, and not much of a current can be expected between two substances both positive. I have since that time more than once seen it in print that aluminum plates could be used for this purpose. Those who published such statements surely have never constructed and tried such a battery.

I discovered in this connection a curious illustration of unipolar conductivity; when a platinum and aluminum plate are used as electrodes for the decomposition of acidulated water, in a voltameter, and the aluminum plate is connected with the zinc pole of a moderately strong battery, the development of gases goes on normally, and the current strength is as would be expected; but when the current is reversed so that the hydrogen is developed upon the platinum pole there is at once a great resistance established; the current is very weak, not one tenth part of the strength as before, while the evolution of gas is proportionally small. I am aware that such a behavior takes place with a plate of iron or other easily oxidizable metal, but then there is a very strong oxidation at the plate connected with the zinc pole of the battery, and the resistance is not reduced at once but gradually. In the case of the aluminum plate, however, the maximum resistance is developed at once, and is not changed in the least when reversing the current repeatedly. There is also not the least oxidation seen at the surface of the aluminum plate, which remains bright. I ascribe the phenomenon to an invisible film of occluded oxygen formed instantaneously on the surface of aluminum, which film is at once dissolved and water formed when the current is reversed, and the hydrogen evolved there.

It appears to me that the behavior of aluminum when used as the negative electrode furnishes an additional explanation why the substitution of aluminum plates for platinum in the Grove battery is a failure. In the battery the oxygen required for the oxidation of the zinc is set free in the porous cup by the decomposition of the nitric acid contained therein, and carried by the current to the zinc; if aluminum possesses the capacity to condense instantaneously a badly conducting film of oxygen upon its surface, or rather, of occluding oxygen among its superficial atoms, it will prevent the current from carrying this oxygen to the zinc, which in this case will not oxidize,—as the behavior of such a battery shows to be the case. This oxidation can, however, at once be started when a strip of platinum, immersed in the acid of a cell, is brought in contact with the aluminum plate, when that cell will become active at once.

In the discussion which followed the reading of the paper, Mr. C. O. Mailloux, referring to the method of soldering aluminum, stated that he had employed for a flux the ordinary chloride of zinc to which oxide of zinc had been added. With this flux, which had been devised by Dr. C. J. Lawler, of Brooklyn, copper could be soldered to lead, iron to iron, etc. Aluminum has also been successfully soldered with the ordinary solder by employing this flux. The solder is also excellent for making joints in electric wires, as it leaves them clean and bright, without any injurious residue.

* A paper read before the Electrical Section of the American Institute, Jan. 5, 1886.

Examination Questions for Electric Light Inspectorships.

We give below the questions prepared by Mr. Kintner, Examiner-in-Chief in Class Electricity, United States Patent Office, for an examination held last year for an electric light inspectorship of the Treasury Department:

(N. B.—Do not put any work or answers upon this sheet. Illustrate by diagram when practicable. Give work in full and plainly indicate answers.)

Question 1.—(*a*) How is the electric light produced? (*b*) Distinguish between the arc and incandescent lights.

2. Give definitions of the following units of electrical measurement, and state briefly how each is ascertained in practice: 1, ampère; 2, ohm; 3, volt.

3. State Ohm's law and give the equation which expresses the relation of electrical units involved.

4. Define the expression "electromotive force."

5. Suppose one horse-power expended upon a dynamo to generate a current of 1 ampère through a resistance of 746 ohms, what horse-power will be required to maintain a current of 10 ampères through a resistance of 6 ohms?

6. What should be the resistance of a lamp in order that when placed in the circuit of a dynamo having an E. M. F of 65 volts it may utilize ½ horse-power?

7. (*a*) What is the peculiarity of a series arc lamp regulator which adapts it for use in series with other lamps of like nature? (*b*) Describe some well-known form of series arc lamp regulator as the Brush, Weston, or Thomson and Houston.

8. (*a*) What is the law governing the distribution of currents in multiple arc branches of an electrical circuit? (*b*) What is the resistance of 20 lamps of 25 ohms each, arranged in 5 branches, consisting of 4 lamps in series?

9. Describe a Brush dynamo machine, and give a diagrammatic view showing the circuits through the field magnets and armature bobbins.

10. In order to secure the greatest safety and economy in the use of street or house mains in an electric light plant, how would you dispose of them and how would you vary their cross section as they recede from the generator? Give reasons.

11. What is a safety cut-out, and how is it utilized in an incandescent system? Describe some form of safety cut-out with which you are familiar.

12. What is an ampère meter? Describe some form of the same known to you, and state how you would use it in practice.

13. What is a volt meter, and how does it differ from an ampère meter?

14. How would you arrange a plant so that arc lamps in series and incandescent lamps in multiple arc could be utilized at the same time from one generator? Give a diagram showing the same, and the regulator therefor.

15. (*a*) Describe and illustrate some form of automatic regulator for a dynamo, located at the machine, and designed to regulate the current for arc lamps in series. (*b*) Indicate what change it would be necessary to make in order to apply it to a multiple arc system of incandescent lighting and state why the change is necessary.

A Deserving Operator Remembered.

The late H. M. Hoxie, general manager of the Missouri Pacific Southwest system, was a man of remarkable memory. There never was a man connected with the Missouri Pacific who stood by faithful and loyal employés with more fidelity than he. On the night of Feb. 14, 1885, bridge No. 37, about seventy-five feet long, built on piles, took fire, probably from a passing train. The bridge is about one-third of a mile north of Paris, Mo. The night was windy, and when the fire was discovered it was an insignificant blaze. A lad who was night operator at Paris saw the flame, hastened to the spot and by perseverance extinguished it and then flagged approaching trains. Ten days later the young man received the following letter:

ON THE ROAD, Feb, 21, 1885.

E. H. Sladek, Esq., Operator, Paris, Mo.:

DEAR SIR: I am informed through our Superintendent of Telegraph that you were instrumental in putting out the fire at bridge No. 37, near your station, on the night of Feb. 14. I take this occasion to compliment you for your efficiency in looking after the interests of the company, and I trust that you will meet such returns from the company as you deserve for your gallant action. Yours truly

H. M. HOXIE, Third Vice-Pres.

About one month before Mr. Hoxie died he telegraphed to Mr. Hammond, Superintendent of the Missouri Pacific Telegraph at St. Louis, asking what had become of Sladek. He replied that he was occupying a humble position as night operator. Mr. Hoxie directed his promotion. He was ordered to Sedalia, and he now occupies a re-

A Novel Telegraph Arrangement.

In the ordinary or Morse system of telegraphy, the instruments for the transmission and reception of dispatches comprise a sounder, with or without a relay, a make-and-break key, and a switch combined with the key and in position to be easily manipulated by the hand of the operator by which he works the key. The function of this switch, as is well known, is to make or break the circuit from line to earth, according to whether the operator is receiving or transmitting. Recently, however, Mr. John Absterdam has devised a system of telegraphy on a somewhat different plan from the Morse, and for which the ordinary switches are inadequate. This system comprises a battery at each end of the line, with similar poles opposed. In operating the line, the battery is disconnected at the sending station, and the anvil of the sender's key is connected with ground, so that by the manipulation of the key the signals are produced by the receiver's battery and reproduced at the sending station by the relay located there. The object of this is to certify the dispatches without re-transmission, it being evident from the disposition of the batteries that the signals produced by the sender's relay are necessarily the same as those produced by the receiver's. To accomplish this object a switch is provided, the particular function of which will be explained presently.

The accompanying diagram, Fig. 1, shows the system containing the two opposed batteries and provided with a way station. The modified terminal key is shown enlarged in Figs. 2 and 3, which are respectively a plan and section.

We will suppose for the sake of illustration that New York and Boston are the terminal stations and Hartford the way station. At each terminal station the apparatus consists of a battery *B*, *C*, a relay-sounder *D*, *E*, a key *F*, *G*, and a switch. After passing through the receiving instrument, the line runs to the metal key and to the lever *H* of the switch, which is always in metallic contact with the key-lever, either by a special connection or through the metal bed-plate upon which the key is supported. From the insulated anvil *a* extends a metal strip *b*, both anvil and strip being insulated from the bed-plate *c*. When, therefore, the switch lever is turned into contact with strip *b*, the line is brought to the anvil and the conditions of the circuit are not affected by the manipulation of the key. The lever *H* is connected with a disc of insulating material *K*, upon which are two metal cross-strips *d*, *e*, brought to different positions. Connected with the bed-plate *c*, but insulated therefrom, are certain stops or points, with which the strips *d*, *e* are brought into contact during the movement of the disc *K*. One of these points *f* is connected with the insulated anvil *a*. Another point *g* is connected with the line-pole of battery *B*, and is located in such position that when one end of strip *d* rests on point *f* the other will rest on it. A third point *h*, connected to ground and to the grounded pole of battery *B*, is placed in such position that the one end of strip *e* will bear upon it when the other end bears on point *f*.

The arrangement at each terminal station is the same. Normally both switches are turned so that like poles of the batteries are to line and opposed.

An operator at Boston to signal to New York turns his switch to the right until the lever *H* leaves the arm *b* and strip *e* bridges points *f h*. This cuts out battery *B*, interrupts the line, and connects the anvil *a* to ground. By working the key, signals are transmitted by battery *C* and the relays or receiving-instruments operated in unison.

Without change in the construction of the switch it may be applied to a way-station by making proper circuit connections.

In illustration, suppose the line enters a way-station, Fig. 1, at switch *k* and leaves at switch *l*. From *k* to a point *l'* in the path of switch *l* is a connecting-wire *m*, which cuts out entirely the way-station when switch *l* is turned onto point *l'*. From wire *m*, however, is a wire *m'*, through a relay *L*, and thence to the key and switch-lever. The anvil *a'* of the key *B'* is connected with an insulated point *b'*, in the path of switch *l*, so that if the switch be turned to bring the switch-lever *H'* on the arm *C'* and switch *l* turned onto point *b'*, the current passes through the apparatus of the way-station, and all signals that are transmitted over the line work the relay *L*.

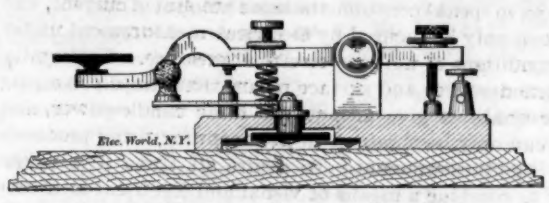


FIG. 3.—KEY AND SWITCH—SIDE VIEW.

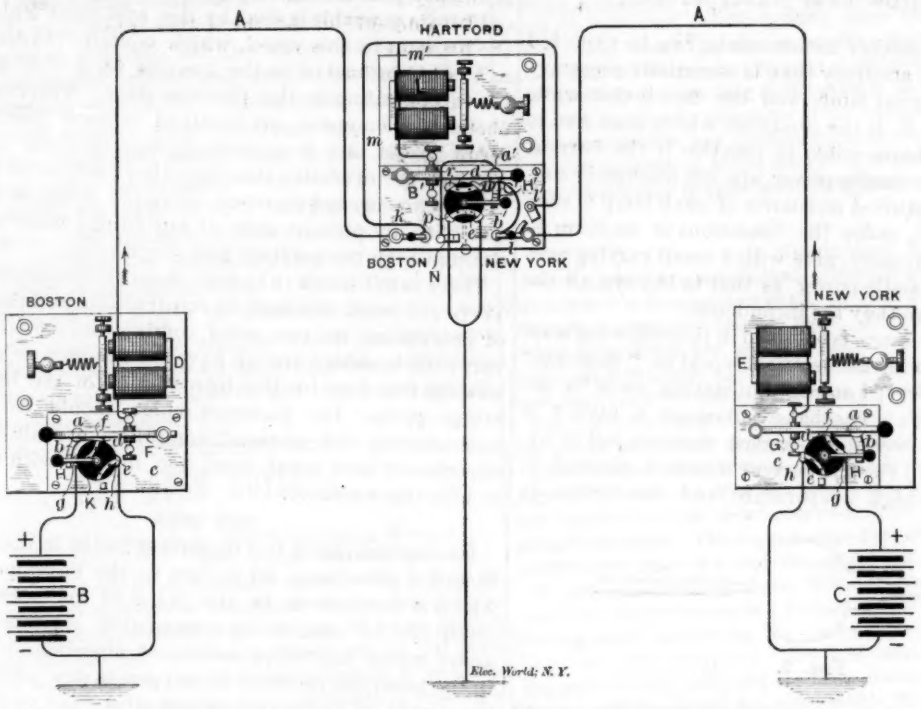


FIG. 1.—A NOVEL TELEGRAPH ARRANGEMENT.

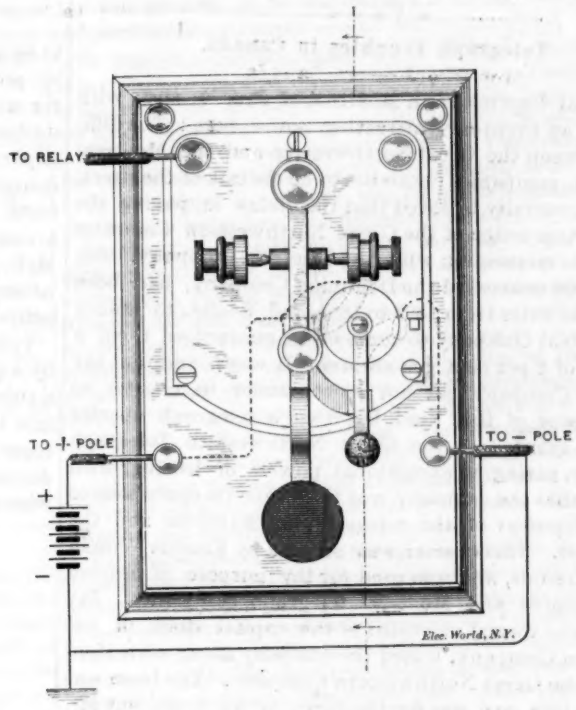


FIG. 2.—KEY AND SWITCH—PLAN.

If the operator at the way-station Hartford wishes to telegraph, say to Boston, he turns the lever *H'* until it leaves the arm *C'*, and the strips *d' e'* bridge the points *n*, *o* and *p*, *r*, respectively, but keeping the lever *H'* out of contact with an insulated contact *N*. In this condition of things the battery at New York is grounded through a wire *p'*, Fig. 4, from the point *b'* to the anvil *a'*, thence to the contact *N* through wire *o'*, thence through wires *n'*, the strips *d'*, *e'* and to the ground. The anvil being grounded and the circuit from Boston interrupted, the manipulation of the key signals to Boston by the battery located there. To signal from the way-station to New York, the switch *k* is turned so as to interrupt the circuit, and lever *l* is turned into contact with stop *l'*. Lever *H'* is also brought to a position in which the anvil *a'* is grounded—that is to say, the stops *n*, *r* are connected with stops *o*, *p* respectively, by the strips *d*, *e*, but lever *H'* is out of contact with stop *N*. If the key *B'* be then worked, the battery at New York will be operated and the signals produced by the relay *L* and the relay at New York. Provision is thus made for signaling from the way-station to either terminal by means of the battery located at the terminal to which the signals are sent. The instrument is, however, capable of being used in other ways and for other purposes. For example, the terminal batteries may either or both be grounded at the way-station, or the line may be completed through the way-station and interrupted by the manipulation of the key; but these matters will be readily understood from the foregoing description.

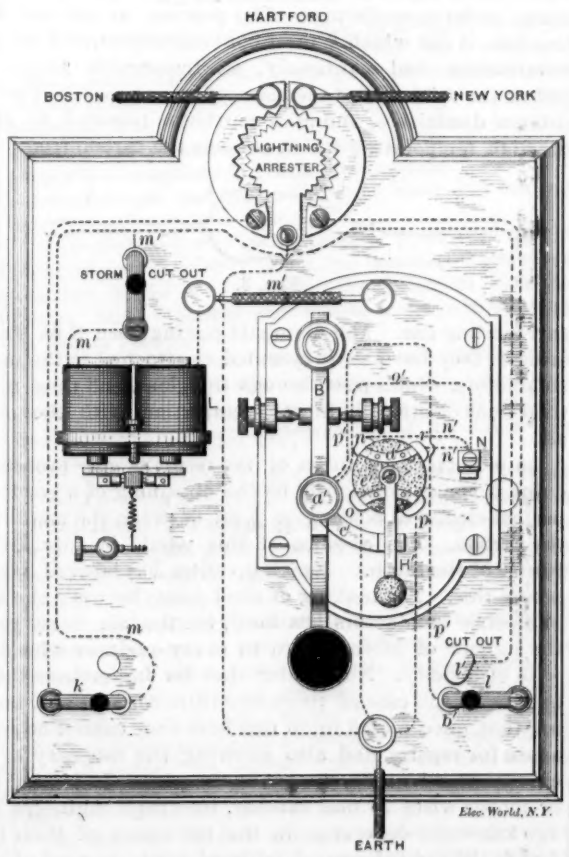


FIG. 4.—ARRANGEMENT OF WAY-STATION.

At both terminal and way stations lightning arresters and storm cut-outs are inserted, the manner of connecting them being shown in Fig. 4.

The advantages of the method, according to the inventor, are, that it simplifies the adjustment or arrangement of the apparatus in a system of this kind, so that the manner of operating the instruments is practically the same as that in the ordinary systems. All the necessary shifting of contacts is effected by a simple movement of a lever.

Electric Lighting from the Eiffel Tower.

A member of the Austrian Society of Engineers and Architects contributes to a recent number of their journal some interesting calculations, intended to show that the project of lighting the whole of Paris by an enormous arc lamp, placed on the top of the proposed Eiffel Tower, is utterly absurd. He bases his calculation upon the present custom of using 10-candle gas burners in the streets, which produce on the pavement an illumination of 1.6 metre candles; and to obtain the same illumination at the foot of the tower, it would be necessary to employ an arc lamp of 144,000 candles, provided the atmosphere is perfectly clear; but making allowance for the usual state of the atmosphere, he estimates that nothing less than 300,000 candles will give sufficient illumination to enable a person standing at the foot of the tower to read small print.

The French Cable Company and the Pool.

The recent successful efforts in France of some of the stockholders in the French Cable Company to overthrow the Pouyer-Quertier administration have naturally been followed up by a quarrel in the "pool," the contention of the dissatisfied holders being that French interests were sacrificed at all times, and especially by the existing "cut rates." Under the pooling arrangement, the earnings were alloted as follows: Western Union, 22½ per cent.; Anglo-American, 48 and a fraction; Direct Cable, 16 and a fraction; French cable, only 12 and a fraction. The probability is that at the present rate of only 12 cents a word, the French Cable Company finds its percentage to bring in a very small and inadequate income, and hence the trouble. It has, it may be assumed, asked, like the famous Oliver Twist, for more, and, having been refused, will not remain in the "pool," unless it can get better terms. Mr. Francis Fisher, Superintendent at Sidney, Cape Breton, of the French Cable Company, was unable to give any information regarding the probable withdrawal of that company from his pool upon his arrival in this city on the 8th inst. He expressed surprise at such rumors, as he had heard nothing of the sort. The orders he received before starting were to come to New York and await instructions. He had no idea, he said, what these instructions would be. Another official of the company is said to be on his way here from France, and he will probably assume charge of affairs upon his arrival. Should the French Cable Company decide to withdraw from the pool, it does not follow that it will be allowed to do so without

fight, as it is a party to a pretty stiff contract. Its withdrawal would entail some trouble and expense also upon Western Union, as the French company owns the telegraph line between this city and Cape Cod, and the Western Union's lines are attached to its poles.

Dr. Norvin Green, president of the Western Union Company, said that he did not see how the French lines could leave the pool. The contract, he declared, was as binding as it could be made. The English cable companies had given notice, on receipt of the announcement of the intentions of the French lines, that the latter would be held to the contract. Dr. Green said that when the pool was formed a contract was also made with the Western Union Telegraph Company, by which all the cable business was to be given to the Western Union.

"What land connection will the French Cable Company be able to make with New York from the landing at Cape Cod?" was asked.

"The French company had a land connection," replied Dr. Green, "but that was leased to us when the pool was formed. The lease has forty-five years yet to run."

It is said that the pole line has two French wires on it and nine Western Union.

Telegraph Troubles in Canada.

A special dispatch from Montreal of Jan. 5 says, with regard to an event now attracting notice here: The difficulty between the Great Northwestern and the Montreal telegraph companies continues to be the talk of the street, and it is generally believed that the delay in paying the dividend is a dodge of the Great Northwestern Company to sever its connection with the Montreal Company. Jay Gould, who controlled the Dominion Company, had been cutting the rates from 1879 to 1881, and finally, to induce the Montreal Company to come in, he guaranteed them a dividend of 8 per cent. per annum. It was found that the Montreal Company had not power under its charter to make a lease of this kind, but that a telegraph charter had been granted to the Great Northwestern Telegraph Company, giving it exceptional powers of leasing, with the idea that the company was to confine its operations to the development of the telegraph in Manitoba and the Northwest. This charter was secured by Erastus Wiman and his friends, and was used for the purpose of leasing the Dominion and Montreal telegraph companies. Jay Gould, who owned one-third of the capital stock of the Dominion Company, leased the company along with Montreal to the Great Northwestern Company. The lease was made in 1882, and was for the term of 98 years, but Mr. Gould took care at the same time to provide that his own company should receive its annual dividend at 6 per cent., payable three months in advance, the dividend to be paid quarterly in the one case and semi-annually in the other.

During the p'st quarter the trouble arose between the Great Northwestern and the Montreal companies about the latter allowing the Canadian Pacific Railway to trespass on their lines, but the Montreal Company took no steps whatever to prevent the trespass. This is put forward as the ostensible reason for the non-payment of the dividend. There is, however, a clause in the contract which provides that in case of a delay of thirty days in paying the dividend the Montreal Company may resume possession of its lines and claim payment from the Great Northwestern Company up to the time of such resumption, the lines to be handed over in good order and condition. This, according to the interpretation of a gentleman who has made a special study of telegraph matters, will enable the Great Northwestern Company to throw up its agreement with the Montreal Company by simply paying the Montreal Telegraph Company the last quarter's dividend, due Jan. 1, and one month of the ensuing quarter, now due, equivalent to a sum of about $10,000. Then the Great Northwestern Company's liabilities with the Montreal Company will cease.

With this done there is nothing, it is thought, to prevent the Western Union Telegraph Company from continuing its connection in Canada with the Dominion Company, the capital of which is $10,000,000, some $400,000 of which is held by Mr. Gould, thus leaving the Montreal Company to look out for itself. One of the directors of the Montreal Company said that it was within his personal knowledge that the property of the Montreal Telegraph Company had been allowed largely to deteriorate, and that it was not to-day within many hundreds of thousands of dollars in as good condition as when it was handed over to the Great Northwestern Company in 1881. The Great Northwestern Company had, he said, a nominally paid up capital of $500,000, which is supposed to be represented by a charter costing some ten thousand dollars and some thirty thousand or forty thousand dollars of telegraph lines erected in Manitoba and the Northwest, which have now been rendered practically useless by the competition of the Canadian Pacific Railway. It is said that dividend checks had been mailed to out-of-town shareholders of the Montreal Telegraph Company last Friday, payment of which was subsequently stopped.

[1] **"Rapid Growth."**—A very neat pamphlet is at hand, published by THE ELECTRICAL WORLD, showing the rapid growth of that periodical and its present importance. The book gives views of the new office in the Potter Building, New York City.—*Fargo Dak.*) *Argus.*

Glow Lamps, Their Use and Manufacture.*

BY MAJOR-GENERAL C. E. WEBBER, R. E., C. B.

(Continued.)

In a good glow lamp, inseparable from uniformity of resistance are uniformity of surface and incandescence. Uniformity of resistance when hot means that each lamp will (so to speak) consume the same amount of current, and this can only be secured by electrical measurement under the conditions of uniform electrical pressure. Uniformity of incandescence and surface means that lamps possessing these qualities give almost the same candle-power, and this can only be obtained in the manufacturing processes by visual measurement. To secure all three it is necessary to combine a means of visual and electrical measurement. The former is but approximate, the latter is as accurate as a Thomson's galvanometer can make it. In either case, however, when large numbers of filaments have

FIG. 1.—GLOW LAMP MANUFACTURE.

to be standardized, neither measurement can be expected to produce greater accuracy than is essentially necessary for a good commercial lamp, and the fact is that while uniformity of E. M. F. is the condition which must not be departed from, no harm arises in practice if the current consumed and the candle-power are not absolutely uniform. Thus, the required resistance of each lamp is such a resistance as will, under the conditions of uniform E. M. F. or electrical pressure, give with a small varying area of surface such a candle-power as that to the eye all the lamps are alike when they are incandesced.

This required resistance is obtained in the following way, by a process known in the electrical world as "flashing," a title which, I believe, I am right in stating, owes its origin to Mr. Lane-Fox: The baked filament is placed in these tongs and lowered into a glass chamber full of hydro-carbon gas. An electric current it passed through it, which raises it to a high temperature, and the carbon in

FIG. 2.

the gas attaches itself to, or is deposited on, the heated surface. The use of this beautiful phenomenon is not essential, but is a very ready and simple means for rapidly increasing the size of the filament, and necessarily in consequence for reducing its electrical resistance. While this is being done the operator is being guided by the two means of measurement already mentioned, so as to know when he has reached the required standard, by reducing the resistance to that point, under a uniform electrical pressure (now generally expressed as "with a uniform voltage"), at which the state of incandescence is reached which yields light of the candle-power required in the lamps under manufacture. The process, as you see before you, is one which is most conveniently carried out intermittently and cautiously, as, inseparable from it, just as the thickness of the filament is increased, so the resistance diminishes, and more current is required to give the high temperature which attracts the carbon from the

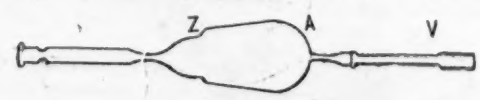


FIG. 3.

surrounding gas. The filaments having been thus standardised, they have to be mounted or attached to the metal conductors, which pass through the glass, and thus make their ends electrically in communication with the outer air.

An important condition of the result of any process of doing this must obviously be the obtaining of a good and perfect electrical contact or joint between the metal and the carbon. The absence of this would be fatal to the future of the lamp. Every inventor has labored hard to secure this. The making of good joints between the ends of electric conductors has been, for the last thirty years, the subject of intense care to every engineer who deals with electricity. No wonder that its importance should be vital in the case of these two little connections, knowing that once sealed up in this bulb they cannot be got at again for repairs, and also knowing the intensity of the current to which they must be the path. In joining iron or copper wires to one another, telegraph engineers long ago knew the difference in the resistance of their lines due to the careful use of soldered joints, instead of leaving them what they call "dry." Various forms of joints have been devised so that the tensile connections between the wires and the surfaces in contact exposed to the deposition of solder should be sufficient to neutralize all resistance. The efficiency of such devices became more important when the joints for the purpose under consideration had to be designed, because of the necessity not only to neutralize resistance at these points in the circuit, but also to reduce it at this point in comparison to that of the carbon. Although this desideratum is ardently sought, in practice it is difficult to prevent heating at the joint when the current exceeds ½ of an ampère. Hence many very ingenious little contrivances, but all having the same object.

Next is the question of the solder to be used, and I believe that no one will dispute that Mr. Lane-Fox was the first to use the process of deposition of carbon by electrically heating the joint in a vessel containing a hydro-carbon surrounding, so as to solder the metal and carbon surfaces to one another. The way in which this is effected is pretty much the same in execution everywhere. The wire mount of platinum wire, or other suitable metallic conductor, is placed in contact with the carbon filament or bridge, so that they are kept together by any suitable contrivance of their ends, and the joint is then flashed. As any further deposition of carbon on the filament itself would alter the standard effected in the previous stage of the process of carbonization, it will not answer to allow any current to pass through it. This is prevented by any simple means of short-circuiting the current, so that it shall only pass through the joint. In the process carried out before you, this is done by this apparatus which holds the filament in this vessel, which contains hydro-carbon in a liquid instead of in the gaseous form you saw used for carbonization in the previous stage. Practically, the chemical phenomena are identical in each case, and the result in this one is a perfectly homogeneous electrical joint, larger in section than the other portions of the path of the current, and therefore of ample strength and conductivity to prevent risk of any future wear and tear through high temperature and rough usage.

There is not much to be said about the platinum mount. There are small details in its construction, and the manner of preventing its two sides coming into contact, which vary little in design and all have the common object. You now see this done by the introduction of the little glass bridge piece. The platinum which should be used, its homogeneity and physical conditions, are all objects of experiment and great care, too minute with which to trouble this audience,

THE BULB.

Having completed this important factor in the construction of a glow lamp, let us turn to the envelope, or bulb, which is destined to be the home of the burner, under conditions for supporting combustion opposite to those under which any other means of illumination will act. In the latter the presence of oxygen in due proportion to the supply of hydro-carbon and other light yielding gases is vital to its usefulness. In the former the presence of oxygen within the bulb and its contact with the carbon bridge is rapid death, instead of the slow decay, ending in extinction, which is the best that as yet can be expected from the glow lamp. Imperfect though it may be, it is, however, very good, and not likely to be superseded.

This little glass vessel has also its stages of manufacture, as you will see by the performance in your presence, the power of demonstrating which, together with the processes previously shown, I owe to the permission of the Board of the Anglo-American Brush Electric Light Corporation, whose factory and offices are situated on the Surrey side of the Thames, just over against Charing-cross. You see that a glass tube of about three-quarters of an inch interior diameter is the foundation. The first stage you see is to produce an object like this (Fig. 1), by drawing out the glass into a small tube of about five inches long, at each end of a section of the original tube about three inches long. Next the small tube is slightly contracted at *A*, when the thick part is heated and blown to this shape (Fig. 2).

Under a second heating, with the object of completing the form of the bulb, it is brought to the following form (Fig. 3).

A Y is then cut off, and another tube of uniform section joined on in its place. This passage is afterward used for exhausting. The bulb is now ready for the introduction of the filament, which has been prepared and mounted in the way you have seen. *Z* is warmed, the end taken off, and it is pressed into an elliptical shape. The filament is introduced, and under the influence of heat the glass is pressed around the platinum leads, and the little loops at their ends only are left projecting. The lamp is now ready for the last part of the manufacturing stage, in which a vacuum within the bulb is produced.

(TO BE CONTINUED.)

* Paper read before the London Society of Arts.

The Westinghouse Transformer System.

We have received a copy of a pamphlet giving the forms of agreement adopted by the Fuel-Gas and Electric Engineering Company, Limited, and the Westinghouse Electric Company, and other information. These two companies, in both of which Mr. Geo. Westinghouse, Jr., holds the balance of power, have made terms by which they propose to work together to promote the general introduction of gas for heat and electricity for light and power. The combination is a powerful one, controlling as it does leading patents relating to natural or fuel gas and a number of electrical patents, including those of the Gaulard-Gibbs system of

transformers, by means of which, it is claimed, the area of supply for incandescent lighting stations can be greatly yet cheaply enlarged. Comparing the "three wire" system with the "alternating" system, the pamphlet thus puts the case: "Say that an ordinary city block will require 500 lights; if the centre of distribution is one hundred feet from the station, the cost of copper for the feeder lines alone will be $2, an insignificant sum; if the block be two hundred feet distant, the feeder wire will cost $8; if five hundred feet, the cost will be $50; if a thousand feet, $200; if one-half a mile distant, which would be the case in lighting a district only one mile square, the cost of the feeder wires alone for a single block would be $1,400. When it is considered that there are approximately two hundred blocks to the square mile, and that the above outline takes in the feeders only, representing about one-half of the total copper, the investment is at once seen to be preposterous and prohibitory. What it would amount to in an attempt to supply the district served by many of our large gas companies surpasses reasonable consideration."

It adds: "The double conversion of the current by the alternating system enormously reduces the amount of copper wire required, not only for the street lines, but also for wiring the houses, stores and other buildings. This double conversion enables the Westinghouse Electric Co. to utilize with success what has long been desired by central station companies, namely, the 50-volt lamp; this lamp having many advantages over the 100-volt lamp, which heretofore has been the only lamp used for central station service. The 50-volt lamp, having a stouter carbon, has a longer life than the attenuated carbon of the 100-volt lamp; the illumination from a 50-volt lamp being given off from a lesser length of filament than with the 100-volt lamp, gives a clearer and more pleasing light; and lastly, the 50-volt lamp, with a longer life than a 100-volt lamp, can be operated on 15 to 20 per cent. less energy per candle-power developed."

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, Jan. 10, 1887.

I had the pleasure of a brief chat last week with Mr. George G. Ward, the general manager of the Commercial cable system. Mr. Ward was a personal friend of Mr. Davies—of whose death I made burried mention last week—and, himself among the most prominent of cable officials, is quick to appreciate the good points of contemporaries who may also have succeeded in winning a name and place for themselves. This is not too common a sentiment, is it? Mr. Ward said: "Mr. Frank Davies, after having been connected for several years with the telegraph companies of England, entered the service of the Egyptian Government. He withstood the cholera scourge which visited that country in 1865, and was one of those who remained at their posts. This action demonstrated his great courage, for which he received the thanks of that government and also six months salary. After leaving Egypt he joined the French Cable Company in 1869, and was one of the electrical staff on board the "Great Eastern" during the laying of that company's cable. He was afterwards transferred to Duxbury, Mass., at which place he remained several years. He then joined the Anglo-American Company at Valentia, Ireland, where he ably assisted Mr. Stearns in perfecting his duplex on the aforesaid company's cables. In 1881 he joined the Central & South American Company and became their General Superintendent. He was a thoroughly practical man of ability and great energy and is a serious loss to the Central & South American. It appears that in looking after some of its cables in Panama he had a relapse and arrived in New York in a very low condition." I availed myself of the opportunity to get a few points on the trouble between the French Cable Company and the other members of the "pool." Mr. Ward gave me a very interesting sketch of affairs, justifying, in fact, his statement that the quarrel must have come sooner or later and that the Commercial Company, with its wonted independence, had absolutely nothing to do with the matter one way or the other.

The Commercial Company, by the way, has issued a large diamond-shaped calendar, on which appears a map showing its cables, land lines, and connections. The date sheets are large enough to receive memoranda.

The New York Safety Steam Power Company report a brisk December business. Among some of their recent sales may be mentioned the following: One 15½×16 inch 150 horse-power automatic cut-off engine to the First Cincinnati Electric and Illuminating Company, at Cincinnati; two large engines to be used for electric lighting purposes in Minneapolis, one being for the Syndicate Block and the other for the Grand Opera-House of that city. They are also putting a 13×12 inch 90 horse-power engine into the plant of one of the Chicago electric light companies.

S. Kyle & Co. have the control of the watch clock system of the Boston Protective Association for the United States, excepting Massachusetts. The system operates under the patent No. 265,912 of G. W. Adams, covering a watchman's electric register. The system has served most satisfactorily in such places as the factories of the Mason & Hamlin Organ Company and the Boston Rubber Shoe Company.

Jordon & Gottfried, of 208 Canal street, have an enviable reputation as dealers in metals, tools and supplies, such as are required by electricians, machinists and others. They have just issued a large and very interesting card-board sheet, the chief feature of which is a colored diagram indicating the right point of temper for steel for all the various tools and appliances into which steel is made, ranging from the pale primrose yellow for steel engravings tools to the deep violet for screw-drivers, saws and springs. The sheet gives also a list of supplies, and is altogether just the thing to keep hanging in the workshop or laboratory.

The *Commercial Advertiser*, in its usual lively and aggressive way, has been looking into the matter of city lighting, and now claims that too much is paid for the electric lights. It does not dispute the usefulness of the lights, but thinks that they cost more than they should. On the basis that Brooklyn pays only 50 cents a night per light, it is asserted that New York pays $51,903 too much for what it gets. Mr. Dustin, of the Schuyler Company and the general manager of the American Company, both profess to the paper's representative to be willing to take a 50-cent per night contract if they could only get it. Mr. Lynch, of the United States Company, and Mr. McGrath, of the Brush, both stated that they thought the price fair. At the present time there are definite plans for extending the public use of electric lights, putting up another 2,000, and they are badly wanted, but it is alleged that the rates now paid stand in the way. Ex-Mayor Grace, who was a member of the gas commission, said: "I think the price for electric lighting entirely too high, but we could do nothing. Electric light is a necessity now, and no other companies have franchises but these. A great many persons from Harlem appeared before the board of appointment at its last meeting, and urged that electric lights be placed in certain streets of Harlem. The Harlem bridge is now lighted by private subscriptions. I told them that if they could get a light at 50 cents, which I regard as a fair price, I should gladly vote for the extension of the system." Comptroller Loew, another member of the gas commission, said: "I have investigated the subject of electric lighting very thoroughly. I have talked with many prominent electric engineers. They have agreed that the work could be done at 50 cents a lamp and a handsome profit made. As long as the price is as high as it is now I shall not vote for any extension of the system." So the matter stands, but whether any change or not is made in the price, we shall soon see a much larger number of electric lights used. Of course a reduction in rates would help extension along.

W. T. H.

ROCHESTER, N. Y., Jan. 8, 1887.

Your readers are aware that communication by telephone in Rochester is a slow method at the present time; in other words, where there was, now there is none. At this writing the "Telephone Association" are hunting for a system that will not infringe the Bell patent and one that will give better service. Perhaps they are to be disappointed and perhaps not.

The district telegraph service has been very heavily taxed on account of the present situation in telephone matters.

Syracuse has, I understand, refused a license to the local company to do business. The old license had or is about to expire, and the territory has been taken away from the former lessee and given to another. The former lessee thus has an elephant on his hands in the shape of a pole line, equipment, etc.

In general electrical work, Schmid, Kaulber & Co. are the leaders in the Rochester and Buffalo district. They are also the Northwestern agents for the Sawyer-Man Electric Company. They have just completed a 300-light plant in the shoe factory of Reynolds & Eddy here, and are constructing one of 70 lamps in the Shawmut Mill—a very fine roller mill. They have also in process of construction a 70-light plant for E. N. Cook & Co., Buffalo.

The Westinghouse distribution system, by means of transformers, is in use in Buffalo. The plant is run by the Brush people, who are half a mile from the business portion of the city. Some 300 or 400 lamps are being lighted. It is too early yet to speak of results.

The Edison Company have placed a plant of 100 lamps for G. D. Born, Buffalo.

The Edison station in Rochester has been increased by an addition of new machinery to the present plant.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Jan. 10, 1887.

The Franklin Electric Light Company has been incorporated, and will at once commence work on a large electric light plant at Montagué, Mass.

During the present week the installation of an electric light plant will be commenced at South Framingham, Mass. A large number of both arc and incandescent street and commercial lights have already been ordered.

Mr. Patrick Fay, who has been several years with the Brush Electric Light Company, of Boston, has been elected general superintendent of the new consolidated company, viz.: The Boston Electric Light Company, and will have charge of the immense stations of that corporation.

Mr. H. M. Stevens, who was with the Merchants' Electric Light and Power Company, of Boston, for about five years, and who stands high as an expert electrician and a careful worker, has been appointed assistant superintendent of the Boston Electric Light Company.

The Citizens' Electric Light and Power Company, of East Boston, Mass., is doing, it is said, a very successful business, and is now furnishing arc lamps up to the full capacity of its plant. Under the excellent management of Mr. Edward S. Sears (who is also treasurer), this enterprise has been a source of considerable profit to its promotors.

The Loomis Electric Manufacturing Company, of New York, has been incorporated, with factory at South Boston, Mass., and New England Office in the Equitable Building, Boston. The officers are: John Warner, president; George L. Stevens, secretary and treasurer, and Osborne P. Loomis, electrician. The object of this corporation is to manufacture, supply and install what it terms "the Loomis system of arc and incandescent electric lighting in cities, towns, public buildings, factories, etc. etc."

The Schaefer Electric Manufacturing Company reports business as now being much better than at any other period since its organization. Its lamps are being more and more appreciated as their meritorious features become known. Many electric light companies who have used the Schaefer lamps are now sending in larger orders. Among the recent shipments of lamps made by this company were the following: Daft Motor Company, New York; Enterprise Electric Manufacturing Company, New York; Wachusett Electric Light Company, Fitchburg, Mass.; Taunton, Mass., Electric Light and Power Company; and Texas Electric Light and Power Company, of Dallas, Texas. In addition to several large orders filled for primary battery companies, large lots of lamps have been shipped to California and other far Western points. In a recent interview with the president of the company Mr. L. Schlegelmilch, that gentleman made the following statements about the Schaefer lamps:

"Our 50-volt standard lamps can be varied from 45 volts to 50 volts, and are kept so in stock. They can be made to order for from 50 to 150 candle-power. Our 100-volt standard lamps also can be varied and kept so in stock from 90 volts to 104 volts. To order, they can be made from 50 to 150 candle-power. We also make 16 and 20 candle-power lamps for 35, 65, 70 and 75 volts. We have just made some 4, 5, 8 and 10 ampère lamps for arc light circuits, giving from 20 to 200 candle power."

The electrical students of the Massachusetts Institue of Technology visited Harrison Square, Boston, on Jan. 7, and inspected the interlocking switch signals there in use.

The telephone line between Rockland, Maine, and the White Head life-saving station has been completed. The cable is 900 feet long, and connects the station with the mainland. It will be a great benefit to mariners coasting along that dangerous shore.

The Mexican Central Telegraph and Telephone Company paid its second semi-annual dividend of 2c. per share on Jan. 3. This corporation is the largest of the telepone sub-companies in Mexico. It is doing business—and has an exchange—in each of the following cities and towns, viz.: Guanajuato, Silao, Zacatecas, Guadalupe, San Luis Potosi, Gueretaro, Aguas Calientes and Veta Grande. It is said that this is the only sub-telephone company in Mexico successful in its business operations.

Mr. Selwyn L. Harding, of the class of '88, Massachusetts Institute of Technology, died recently at his home in Cambridge of acute peritonitis. He had been ill but a few days, accompanying the Electricals on their excursion to Fitchburg on Saturday, Jan. 1. Mr. Harding was a graduate of Harvard University, receiving his degree with the class of '86, and although at the institute but a short time, had already won the highest opinions of both students and instructors, who feel his loss most keenly.

The Electric Gas-Lighting Company has removed its offices and show rooms from No. 45 Milk street to more extensive and very conveniently located quarters at No. 85 Arch street, Boston. This step has been taken owing to the steadily increasing demand for the company's manufactures, which has made necessary an enlarged place of business where the varied line of gas-lighting apparatus and electrical supplies can be advantageously exhibited. The new store is fitted up with attractive counters, desks, etc., made of cherry wood. The handsome exhibiting boards on the walls are covered with samples of the company's popular single magnet ratchet automatic gas-lighters, the new "Victor" call bells, etc., etc. Elegantly furnished offices for the directors and superintendent are in the rear.

For several years past there has been in existence in Philadelphia a rotary braiding machine, two discs revolving in opposite directions, carrying the spools, the threads from one set being automatically lifted over and under the other set of spools, thus forming the braid. Heretofore this machine was not capable of being reversed to undo bad work from broken threads, but now it has been improved so as to accomplish this. Other improvements, including automatic stop motion, have been made, so that the machine can be run, it is said, at four times the speed of other style braiders now in use, turning out four times the amount of work with one-fourth the power, space and number of employés. Many of these improvements have been made under the personal supervision of Mr. H. A. Clark, general manager of the Eastern Electric Cable Company, Boston, who is also general manager of the Boston Braider Company, which now controls the patents, and is making arrangements to put the machines on the market.

The Telegraphers' Mutual Aid and Literary Association gives its second annual ball in Odd Fellows' Hall Friday evening, Feb. 4. The Boston Cadet band will furnish music. The officers of the association are: E. J. O'Conor, President; R. E. Tobin, Vice-President; George H. Winston, Recording Secretary; M. C. Harrington, Financial Secretary; M. W. McLeon, Treasurer; D. J. Donovan, Sergeant-at-Arms.

The interference proceedings which have been going on in the United States Patent Office for the past year and a half between Morris Martin, of Boston, Mass., and Charles E. Buell, of New Haven, Conn., involving the title—broadly—to the method of distinguishing between an accidental break and a break in a closed circuit caused by the the action of a thermostat or other circuit-controlling instrument, has finally been decided by the Commissioner of Patents in awarding priority of invention to Mr. Martin.

The offices of the Electrical Development and Manufacturing Company, 197 Congress street, Boston, have been refitted and refurnished, and are among the most attractive and cheerful-looking business places in the city. The President, Edwards H. Goff, intends to make this his headquarters whenever he visits Boston. Mr. A. R. Brown succeeds Mr. R. M. Kimball as general manager and superintendent, and Mr. Cyrus W. Bishop continues as treasurer. The company's business is very satisfactory, and its affairs are in an excellent condition.

The Boston Rubber Shoe Company are calling special attention to the Climax tape for electrical purposes. The reputation of the company as the largest manufacturers in the world of rubber boots and shoes is sufficient to guarantee the character of this product, and there is, moreover, the advantage of dealing at first hand. No oil of any kind is used in this tape, but only the best rubber. The company say that a point that ought to be understood is that many tapes which have the appearance of being good, because they are so sticky, are virtually worthless because they are made of the cheapest grade of gum. Tape too sticky should not be purchased, as the moisture it possesses soon leaves it, rendering it of no use at all. The Climax will stand all kinds of weather.

A meeting of the stockholders of the Orcutt Electric Signal Company was held yesterday, Morris Kenally, of Cambridge, acting as chairman. A report was read of the progress made in placing the signals of the company on the Lowell Railroad. It was stated that the section now being placed on the Arlington branch of the road mentioned would be completed and an engine equipped by Feb. 1, when a public test will be made. It was voted to increase the treasury stock and the number of directors. Remarks were made by Hon. C. A. Lincoln, James W. Brine, Professor Amos E. Dolbear, of Tufts College, Professor Buck, of the Somerville Electric Light Company, Mr. Orcutt, the inventor, and others.

W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, Jan. 8, 1887.

I have frequently referred in this column to the superior facilities possessed by Munson & Company, of 240-242 Randolph street, this city, for manufacturing belting. Mr. Munson, the proprietor, has, as is well-known, made a study of the necessities in the way of belting for electric light stations, and the result is a highly satisfactory belt largely in use among electric light people. Mr. Munson's method is to deal direct with the consumers. Not only does he make a general study of the requirements of a particular trade, but in filling orders he in each case makes a careful investigation of the requirements of the particular plant in question, and thus insures the perfect adaptability of the belting to the use required of it. Not long ago Mr. Munson made a double belt 64 inches in width for the Fort Wayne Jenney station at New Orleans. He also made for this plant other belts which were 40 and 52 inches wide, and 1,000 feet of belting of ordinary widths. This order showed to Mr. Munson the fact that the requirements of the electric light business often necessitated ability on the part of the manufacturer to fill promptly very large orders comprising belts of all sizes and many of them 5 or 6 feet in width. Mr. Munson, therefore, had built for use in his factories a mammoth hydraulic press capable of producing a belt 74 inches in width and of any required thickness. This press was illustrated, I notice, in THE ELECTRICAL WORLD of January 1, on advertising page x., and is, I suppose, the largest machine of the kind in the world, having a capacity of 230 tons. This machine offers a striking contrast to the one illustrated on the same page, in use by many manufacturers, and having a capacity of only 10 tons. The facilities of the Munson establishment are now unexcelled, it is said, by any concern of the kind in the world.

Mr. J. H. Reid, representing the Mather Electric Company, at 117 and 119 Lake street, Chicago, informs me that the prospects for business in his line are exceedingly good. He has already placed orders for a 700-lamp incandescent plant to go in the new Hennepin Avenue Theatre, Minneapolis, Minn.; for 120 lights at Winona, Minn., and for 200 lights for the hospital at Hudson, Minn.

Representatives of the Waukegan Electric Light Company have been in town looking at arc lights. They propose to start in up there with 40 lights. The incorporators of this company are Geo. R. Lyon, Edmund D. Besley, John F. Kuhn, Clarence A. Murray and Robert S. Perine.

On dropping into the office of Mr. S. Taussig, 43 River street, this city, I was greeted with the salutation, "Hello! You are just the man I want to see. I want to show you what is thought of the Synovial dynamo oil hereabouts." Whereupon Mr. Taussig began to pull out of his files, letters and testimonials without end. I always like to speak a good word for any article of merit, and I therefore made copies of two of the numerous letters that Mr. Taussig has from Western electric lighting companies, and will reproduce them here. One of them says: "We find that the Synovial oil, which we have used for a year or more, gives us better satisfaction than any other we have tried for the same purpose." The other testimonial reads: "The Electric Lighting Company recommends this oil exclusively for its dynamos."

I find that Synovial oil is in use by the following electric light companies and plants: Zanesville, O., Electric Light Company; Durango, Col., Electric Light Company; Omaha, Neb., Illuminating Company; the Southern and Woodruff hotels, Chicago; Board of Trade, Chicago; American Express Building, Chicago; Western Electric Company, Chicago; Brush Electric Light Company, Minneapolis, Minn.; Lake Gas Company, Illinois; United States Custom House, Chicago, and many others. I have visited two of these plants where Synovial oil is used and in every case found it highly spoken of by those in charge, it having superseded other oils in many instances. Chief Engineer Cobb, of the government building, says that he "will use no other oil."

The government building in Chicago, which has now in the neighborhood of 1,100 incandescent lights, is completing arrangements to increase the installation to 2,500 lights. A new Porter-Allen engine and Southwark Machine Company's boilers will be put in.

Messrs. H. P. and C. A. Pratt, of Chicago, have invented a pneumatic telephone and train signal which can be applied to either freight or passenger trains. This invention furnishes means of signaling the engineer from any part of the train. This is done by exhausting the air in a valve at the point from which the signal is sent, this exhaustion producing a collapse of the receiver in the cab of the engine and a consequent signal to the engineer.

An electric light and power company has been organized at Seymour, Ind., with a capital of twenty thousand dollars.

Prof. John P. Barrett, city electrician and superintendent of the municipal telegraph service, wants to see Chicago lighted by electricity, and he wants the city to undertake the job. The City Council recently asked Prof. Barrett to estimate the cost of lighting the river along the main branch and from Chicago avenue to Twenty-second street. While he was studying this problem he reached the conclusion that no city in the country possessed the advantages Chicago had for putting in electric plants that would light the entire city.

"The city," he said, "owns all the street ends, and it would not have to buy any ground for buildings to contain the plants. All it would have to do would be to erect the buildings and put in the dynamos. Coal could be unloaded from the boats into the engine-rooms. Wires could be run from these plants along the principal streets and branch off into cross streets. If the city needed more plants they could be placed in the rear portions or basements of the fire-engine houses. More light can be had for less money out of the arc light than in any other form. The first cost of the plants is where the expense would come. Nearly $700,000 was appropriated for lighting the city this year. Give me that much money and I will put in a big electric plant. The streets are not lighted now. It is hardly safe to attempt to drive a horse about some parts of the city. Electric lights would make the streets almost as light as day. Brooklyn started a little over three years ago with fifteen lights of its own. It has over nine hundred now. Philadelphia has put in about four hundred lights. The business men on Chestnut street lighted that thoroughfare at their own expense. Buffalo, Rochester, Oswego and New York city are putting in electric lights. New Orleans has no other light. Private corporations light Cleveland, Toledo and Detroit with electricity. A number of smaller towns are lighted the same way. I am in favor of the electric light, but I want the city to own the plants. Chicago has lights on two bridges only. The fact that we require the wires to be put underground has kept electric light companies out of the field. Still, many buildings are lighted by electricity, and if private persons can afford the expense the city can. The arc light is fit only for street lighting. We have underground conduits for electric wires in the south side, north of Van Buren street, and in portions of the north and west sides. A plant at the foot of Washington street would be in the midst of this net-work of conduits. We have a nucleus for a plant now that may easily be extended over the entire city. I would like to see State and Clark streets, Milwaukee and Blue Island avenues, and other trunk thoroughfares lighted by electricity at once."

For lighting the river, Prof. Barrett proposes to put in a plant at the foot of Washington street, where the city has an engine house and pumps for removing the water from the tunnel. He suggests that iron-armored cables, such as are used in the submarine cable service, be laid along the dock and looped to the piles by iron bands. One loop of cable he would lay in the main branch of the river, a second from Washington street to Chicago avenue, and two more south to 22d street. He proposes to place a light at each street end along the river and four at each bridge, one on each side of both approaches. This arrangement, he believes, would light all the viaducts and the river, no matter in what position the bridge was turned. The engine used to run the dynamos at night could be employed in pumping out the tunnel during the day. The operation of this plant, Mr. Barrett thinks, ought to be constructed with a view to extending the lights along the principal streets. He hopes it will be the entering wedge for supplanting gas with electricity.

The Le Grande interlocking electric signal system for the protection of railroad crossing at grades, junctions, etc., recently put in at the crossing of the J., M. & I. and the Belt roads at Indianapolis, was the past week subjected to several tests in the presence of a number of railroad officials, all of whom were more than pleased with its operations. This apparatus is practically new, but the several tests it has been put to give evidence that it is to work a revolution in this particular branch of railroad service, and its perfect working in every detail since it was put in, without the slightest interruption, clearly demonstrates its thorough practicability and superiority over all other systems. Its construction and operation is a radical departure from all other interlocking systems yet devised, inasmuch as by the use of one lever the operator can accomplish all that is now done by a multiplicity of levers; that is to say, any given number of semaphores can be actuated by the movement of this one lever. The lever is locked against all trains not having the right of way, and it is also locked against the operator himself in both positions of the semaphores (*i. e.*, clear and danger) as, also, when a train is upon any one of the trackages protected by the apparatus. In other words, at the normal position of the semaphores "danger," the lever is locked against the operator; when a train enters any one of the tracks it is electrically unlocked, and may be thrown over to give "clear" signal, upon reaching which it is again locked, and is only unlocked by the passage of the train off the block. So that, it will be seen, the operator is powerless to give but one "clear" signal at a time, and that only to the train having the right of way, even if there be two or more trains waiting for the "clear" signal.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$157@$160
Central Union	48@ 49
Chicago	375@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Iowa Union	16@ 19
Michigan	71@ 73
Rocky Mountain Bell	40@ 45
United	18@ 20
Wisconsin	104@ 106

W. A. K.

KANSAS CITY, Jan. 8, 1887.

The local papers have been giving some figures of electrical extension hereabouts. The statistics are interesting.

The Home Telegraph and Signal Company was organized in 1882, Mr. E. L. Martin President and George M. Meyers General Manager. It has 50 miles of wire and 600 call boxes in circuit. It also has 175 night watchmen signal boxes in circuit, from which a signal is received at stated intervals during the night with fire and police signals attached. In case a watchman fails to turn in his signal at the proper time a special messenger is dispatched on horse to ascertain the reason. The Home Telegraph and Signal Company employs fifty messengers and clerks.

During the past year two new lighting companies were organized, and incandescent lamps for household purposes were introduced. The number of commercial lamps in operation during the past year was 563; incandescent, 400; by the city, 29; total, 1,012; increase over 1885, 762, or more than three times as many as the total number of lights operated before. In order to keep up with the demand there has been an enlargement and improvement of plants during the past year at a cost of not less than $125,000. This has given the various companies a capacity for at least 225 more lamps than the number now in use, and the improvements contemplated for the present year in the way of enlargement of the works, additions and improvements to the machinery, show that the companies already here will be able to supply any demand. In connection with electric light there have been organized companies for supplying electrical apparatus and machinery, the demand having assumed large proportions during the past year, and who find their market throughout the West and South. It is comparatively an infant industry, but already the sales amount to $2,500 a month, and they are increasing with the same wonderful rapidity which all business in Kansas City enjoys. In addition to the plants of the Electric Lighting companies doing business there is a large number owned by private citizens and business firms. It is estimated that about 800 incandescent and arc lights are in the isolated plants, as they are called. Among those of the greatest extent are the plants of Plankinton & Armour, Fowler Bros., government building, Gillis opera house, Centropolis hotel, Chapin & Gore, George Y. Smith & Co., Browning, King & Co., Kansas City Bridge company, Murdock Brothers, Behm & Moffatt and a few others. These are all very successful, giving excellent light and being found very economical. It is estimated that in the ensuing year the number of lamps of both kinds will be greatly increased. With regard to the telephone exchange, the following are the figures given:

Present numbers of subscribers	1,750
New subscribers during 1886	500
Miles of poles erected during 1886	15
Miles of new wire strung during 1886	650
Miles of wire transferred during 1886	30
Feet of conductor cable strung during 1886	25,000
Total cost of improvements during 1886	$28,000
Total cost of reconstruction and repairs	13,000

New extra territorial line to Topeka, Kan.
" " Olathe, Kan.
" " Paola, Kan.
" " Ottawa, Kan.

Fire alarm service extended to include No. 8 engine-house and Assistant Chief's residence.

Multiple switch-boards added during the year, 3.

The toll line service diverging from Kansas City is as follows:

Kansas City to Savannah, Mo., with Leavenworth, Atchison and St. Joseph in circuit, 96 miles, No. 8 steel wire as far as St. Joseph and No. 10 H. D. copper wire between that city and Savannah.

Kansas City to Leavenworth, Kan., a second wire by a different route, 36½ miles, No. 12 H. D. copper wire.

Kansas City to Topeka, Kan., with Eudora and Lawrence in circuit, 67 miles, No. 8. steel wire.

Kansas City to Ottawa, Kan., with Olathe and Paola in circuit, 71 miles, No. 10 H. D. copper wire.

Kansas City to Liberty, Mo., 16½ miles, No. 12 H. D. copper wire.

Coming to telegraphs, growth is again to be noted:

There are two lines reaching from Kansas City to the outer world and one district telegraph company. They employ a total of 390 operatives, clerks and messengers, and have a total of 168 wires leading from the city in all directions. The business for each company follows:

The Western Union, twenty years ago, was doing a small business, to which one man, who is now manager, attended—receiving, sending and delivering the messages. To-day it has a hundred wires leading into the city, with sixteen branch offices, and employs a force of 184 operatives, clerks and messengers. In addition to these they use ten quadruplex, four duplex and three Wheatstone duplex sets, these being equal to about fifty additional wires. There were 344,796 messages sent and 391,032 received during the year, an increase of 50,279 over 1885. In addition to these messages there were 3,708,273 messages repeated, being an increase of 1,089,745.

The Pacific Mutual Telegraph Company, a Kansas City enterprise, was organized in 1883, and built to St. Louis, Mo., and St. Joseph, Mo., in the same year, with purely Kansas City capital.

Mr. E. L. Martin is President and George M. Meyers General Manager. At the start they only had two wires East, and two wires North, but last year they found the business demanded two additional wires East and two additional wires West, giving a capacity equal to thirteen wires East by means of duplex instruments. The Pacific Mutual also extended its lines through Kansas, from St. Joseph, through Nebraska, to Omaha, Neb., and at the close of this year will have 1,000 miles of poles and 5,000 miles of wire in operation. The connecting lines will be in operation from the Atlantic to the Pacific by Jan. 1, 1887. The Pacific Mutual through their connections, work direct wires with Chicago and New York. They have eleven branch offices in Kansas City, and employ 56 people, and the capacity of the system was doubled during 1886. Three hundred thousand messages were sent, and 275,000 received in 1886, the increase in both sent and received messages being 61 per cent. over 1885.

MINNEAPOLIS, Minn., Jan. 3, 1887.

The Globe Electric Company of Minneapolis has lately organized to put in arc and incandescent plants, and will operate in the Northwest. Mr. John Collicott, formerly of Boston, is its general manager, and Mr. I. A. Dunsmore is the treasurer. The general offices and headquarters are here. The capital stock is $50,000.

Mr. E. L. Castle is engaged at Red Wing, Minn., putting in an incandescent plant of 500 16 c. p. lamps of the Hickley system and a number of arcs, the plant coming from the Jenney Company of Indianapolis. He now has nearly all the stores wired, and will probably have two dynamos of 200-light capacity each placed by the end of this month.

TOLEDO, O., Jan. 4, 1887.

There is trouble here among the electric light companies. The condition of affairs is summarized in the following news item of this date:

The fight between the Cleveland and Toledo stockholders of the Toledo Electric Company continues to-day. The five directors representing the local stockholders met and elected the following officers: L. S. Baumgardner, president; G. G. Hadley, vice-president; O. A. Bostwick, treasurer, and F. B. Dodge, secretary. The Cleveland stockholders elected the following board of directors: L. S. Baumgardner, F. R. Dodge, J. S. Rodgers, J. J. Barber, J. J. Barker, W. P. Heston, J. M. Brown, George S. Stock and W. T. Swift. This board of directors afterward organized by electing James M. Brown president; J. J. Barber, vice-president and treasurer, and W. P. Heston, secretary and general manager.

President Baumgardner said to the Cleveland *Plain Dealer* correspondent: "There are four factors in the situation, the Brush, the United States, the Thomson-Houston and the local company. The intense rivalry between the United States and Brush companies had led to a split. The local stockholders of the United States and Thomson-Houston were united against the Brush, and held the balance of power until a few weeks ago. There was a disposition on the part of the Brush management to use a part of the machinery to its detriment, and it was not the Brush plant. To avoid this, and to better protect the local stock holders, a coalition was formed which elected a majority of the directors. It is the same old management, and gives fair representation to all factors in the combination. That is all there is about it. What will be done? We have the law on our side, and I suppose the other fellows will commence suit against us to test

the merits of the case. Until this point is settled nothing can be done."

THE TELEGRAPH.

Conduit Explosion.—A bad explosion occurred this week in one of the Western Union conduits at Chicago.

A Deadly Weapon.—A man has just died in this city from a wound inflicted on him with wire pliers by a telegraph lineman, in a saloon.

Taxing Bucket Shops.—Gov. Hill, of New York, advocates the taxing of bucket shops as the next best thing to their suppression. This means their legalization.

The Phonoplex.—Mr. Frank Kitton delivered an able lecture on Jan. 7 before the Buffalo Electrical Society on the simultaneous transmission of telegraphic and telephonic currents over the same wire. It was a comprehensive address, and included improvements as recent as Mr. S. D. Field's sextuplex.

A Memento.—The employés of the telegraphic department of the Broad Street Station, Philadelphia, have placed in the waiting-room of the depot a life-size crayon portrait of the late Chester T. Clark, who was drowned in July last by the capsizing of the schooner "Sarah E. Craig." Clark was manager of the telegraphic department.

New Jersey Weather Service.—Sergeant Penrod, in charge of the marine signal service at this port, was very busy last week in organizing a State weather service for New Jersey. About forty persons throughout that State have responded to the call issued for volunteer observers. The new stations are designed to fill the gaps between the government signal service stations, which are hundreds of miles apart.

Proxy Holders.—A somewhat novel sight was seen at the meeting of the stockholders of the Boston & Lowell Railroad on Wednesday last, when some 80 messenger boys marched in and by proxies cast votes on the election of directors, representing several thousand shares. The boys, however, seemed to enjoy their temporary importance, and undoubtedly did their duty in as thorough a manner as would have their employers could they have been present.—*Boston Traveller.*

The Canada-Pacific Cable.—The company of Canadian and English capitalists lately formed for the purpose of constructing a line of cable between England and Australia, via the Canadian Dominion, are vigorously pushing the work. Sanford Fleming, C. M. G., the original promoter of the scheme, announces that the company have applied to the imperial government for vessels to conduct the soundings and other work, from the coast of Australia to the coast of British Columbia, and the matter is now under consideration. Mr. Fleming thinks that there will be no difficulty in getting the imperial authorities to either conduct the preliminary operations or to supply the vessels necessary for the work.

THE TELEPHONE.

A Great Misfortune.—The library of Prof. A. G. Bell at Washington has been very seriously damaged by fire.

To Operate in Seventeen Counties.—The telephone subscribers' organization of Rochester, N. Y., decided on Friday last to form a company, under the general telegraph law, to operate in seventeen counties.

The Lowell Arbitration.—The decision in the arbitrator's suit, W. H. Bent vs. Erie Telephone Company, has been overruled by Judge Thompson in the Superior Court on the ground of illegality in the papers extending the time of the hearing. Gen. Butler appealed to the Supreme Court.

Mr. Bell's Check.—Mr. Bell, of telephone fame, has contributed $1000 to the fund for Mrs. Logan. Now, if all the other fellows who claim to have originally discovered the art of transmitting articulate sound by wire would only chip in an equal amount, the subscription list would be chock full.—*Boston Herald.*

The Government Suit.—A special despatch from Washington of Jan. 7 says: The government expects to begin preliminary proceedings against the Bell Telephone Company in Boston before the middle of next week. The counsel will be District-Attorney Stearns, of Boston, and Messrs. Chandler, Whitman and Goode. The counsel held a meeting this evening at the Department of Justice and discussed the case.

THE ELECTRIC LIGHT.

Tampa, Fla.—Mr. S. Pickering, of Cedar Keys, is to put a plant in Tampa.

Sandy Hill, N. Y.—Mr. T. E. Wells is interested in plans for a lighting station.

Yonkers, N. Y.—The house of the Yonkers Club, just opened, is lit by electricity.

Investigation.—An investigation is being made into public electric lighting matters in Brooklyn.

Corning, N. Y., has "caught on," but will not proceed to put in lights until the flowers bloom again.

Hornellsville, N. Y.—The American station is being enlarged, and its capacity will be nearly doubled.

Belvidere, N. J.—The Electric Light Company, Belvidere, propose to put new plants in at Washington and Hackettstown.

Richfield Springs, N. J.—It is proposed to light Richfield Springs by electricity. Mr. R. F. Mescott, Orange, N. J., is interested.

Buffalo, N. Y.—Lautz & Co. are putting in an Edison installation, and several other isolated plants have lately been established there.

Tobogganing by It.—No toboggan slide is considered complete without electric lights. The latest to be fitted up with arcs is that at Corey Hill, Boston.

Brunswick, Me.—The management of the big Cabot cotton mill has the plan of lighting the entire place by electricity under consideration at the present time.

Long Island.—Horace C. Baldwin, of Flushing, and Willard P. Reid, of Babylon, L. I., are among the incorporators of the South Side Electric Light Company, of Islip.

Montague, Mass.—The Franklin Electric Light Company of Montague, Mass., has been incorporated by W. D. Russell and others, with a capital stock of $5,000.

Poor Liberty!—It has been gravely proposed to light the Statue of Liberty with gas, using electric gas lighters and from 1,000 to 2,000 cubic feet of gas per hour.

Erie, Pa.—The Lowell Manufacturing Company have recently installed 65 Edison lights, and the Griswold Manufacturing Company, of the same city, have just completed a plant of 105 Edison lights.

A Federal Station.—It is said that there has been some discussion among government officials in New York of the feasibility of establishing an electric light plant here to provide the Federal buildings with light.

The Erie, Pa., Edison Station.—The building of the Edison Company at Erie is finished, and negotiations are now pending for the setting up of the steam plant of four 135-h. p. boilers with all accessories.

Springfield, Mass.—The Springfield Electric Light Company has been putting in a number of Sawyer-Man incandescents in connection with its fine Thomson-Houston plant, and will require about 400 by spring.

Bad Explosion.—The electric light plant at Fostoria, O., using natural gas for fuel, was wrecked on Dec. 25, by an explosion of the gas, at a time when some tests were being made with the gas, just applied for the first time. The engineer was fatally injured.

Progress in Buffalo.—The Brush Company at Buffalo are furnishing power to the United States Company, and are erecting beside their present station a building for incandescent lighting. It will contain a steam plant about as large as that of the Pearl street (Edison) station in New York.

Mount Morris, N. Y.—The Edison Illuminating Company of Mount Morris, N. Y., has been incorporated, and the Edison experts are now in that city laying out the work for the central station. The town is a progressive place of 2,500 inhabitants, and the company has an exclusive franchise.

Baldwinsville, N. Y.—The Edison central station at the above town is now in successful operation, and has a capacity of about 1,000 lights. It is run by water power and is highly appreciated by the citizens. The electrical work is a credit to Mr. S. C. Katzel, who had charge of the construction.

A Small Fire at Wallace's.—Fire broke out on Jan. 4 in Wallace & Sons' carbon shop, Ansonia, Conn., and before it was got under control the building was so badly damaged that it will have to be torn down. The machinery will also have to be replaced to some extent. The loss is, it is said, $30,000; covered by insurance.

Westbrook, Me.—The dynamos for the electric light plant at the Warren paper mills, Westbrook, have arrived and are being set in position. The engines also have been forwarded. The lighting system of the mills when completed will be large enough for a fair sized town, and comprises 800 incandescents and 20 arc lamps.

Brockton, Mass.—It is reported that a new gas company is projected for Brockton. It is said also that the idea is to consolidate the Jenney Electric Light Company with this Economic Gas Company. It is also stated that the lessees of the Brockton Gas Works are negotiating with the Edison Electric Light Company, to purchase the lease which the latter holds and carry on the work in connection with their own plant.

APPLICATIONS OF POWER.

California.—The Los Angeles (Daft) road is about ready. San Jose wants one also.

Selma, Ala.—It is stated that surveys are now being made for the electric railway to be constructed in Selma.

Pittsburgh, Pa.—A road on Squirrel Hill is projected, to use either steam or electricity, and to connect with the cable line.

Scranton, Pa.—The success of the Van Depoele road continues so great that four more cars have been ordered, to be supplied at once.

Worcester, Mass.—The Worcester & Shrewsbury Railroad is to be operated on the Daft system by the Worcester Electric Power Company.

In an Organ Factory.—The Springfield (Mass.) Electric Light Company has installed a motor in the organ manufactory of Steere & Turner.

Chicago.—The West Division Railway Company of Chicago is looking into the matter of operating by electricity. It runs about 500 cars daily. They travel 25,000 miles daily on about 50 miles of double track. Here is a good chance for electric motor men.

Denver, Col.—The Denver Street Railroad Construction Co. has received from the Brush Electric Co., of Cleveland, a generating dynamo of 100 h. p. and five electric motors of 12 h. p. each. The conduit system used is on the plan said to have been invented by Professor Short.

"A Great Blessing."—In editorial comment on the Julien storage street car system, *Building* says: "It would seem as if this system of moving the street cars would certainly prove a great blessing to this or any other great city, if it did nothing more than diminish the number of horses on our streets."

Riverside, Cal.—The Riverside Land and Irrigating Company, San Bernardino County, Cal., contemplate building an electric railway along the very fine Magnolia avenue running through that town. An electric light plant will be in operation within the next 60 days, lighting three towns from the one station.

Orange, N. J.—Under authority obtained from the local board, the Orange Crosstown & Orange Valley Street Railroad Company will proceed to equip for electric motors, using overhead wires. The poles are to be 75 feet apart and must not carry more than six wires. It is said that the Sprague system will be used.

St. Louis, Mo.—The council committee on railroads has had several deliberations on the Central Electric Elevated Railroad ordinance, authorizing F. A. Mann, G. F. Branham and others to construct a road from Broadway to Berlin avenue and the King's Highway; also an ordinance for another, but similar road; it is claimed that as the cars would not exceed six feet in width they would cause little inconvenience in the 15-feet alleys. The St. Louis Railroad Company has obtained an ordinance passed authorizing the use of any power but steam; and it is stated that electric storage batteries will be used.

Pensacola, Fla.—The Pensacola Street Railroad has been purchased by J. F. Shaughnessy, of New York City. The line will be extended and improved, and it is proposed to operate the line by electricity. The *Picayune* says: "The recent sale of this property has placed it in the hands of men who will utilize all of its unimproved franchises, the first move contemplated in this connection being the laying of track on Government street as far east as the bay shore and west to the corporation limits. Such other thoroughfares, the travel on which will warrant the expenditure, will be included in the extension. Mr. S. F. Chipley, a gentleman of superior executive ability, has been designated the manager of the whole system."

Ventilation and Motors.—In the course of some articles in *Building* on the heating and ventilation of buildings, Mr. F. E. Kidder, a well-known consulting architect, expresses an opinion strongly in favor of electric motors for operating fans. He gives description and cost, and says: "In the ventilation of all buildings where a special engine would be required to run the fan, electricity, where it can be obtained, is the most desirable and cheapest motive power known. Its great advantages are that it is easy of application, requiring no belting or shafting, and is odorless and clean. It can be turned on or off at will, so that no more power is used than is required. The motors are so arranged that they can be run at several different speeds, and can be regulated at will to suit the changes in the weather and any variations in local conditions. Electricity is especially valuable for running small fans in first-class city residences, as they occupy but very little space, can be located anywhere in the building and require no attendance from the owner or servants other than turning the power on or off."

The Detroit Motor, manufactured by the Detroit Motor Company, is made at present in three sizes, viz., $\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{4}$ horse-power. The smaller size is for use by dentists, etc. The second, or No. 2, is for running sewing machines, and the third, or No. 3, for pumping water, running ventilating fans, jewelers' lathes, etc. The No. 2 motor is now in use doing regular work for Mabley & Company's clothing department, where they are on the incandescent circuit of a United States 250-light machine. One of these little motors, the No. 2, weighing 8 lbs., has a capacity of full $\frac{1}{8}$ horse-power. With an E. M. F. of 10.75 volts this motor will run a sewing machine (the Domestic) 1,000 stitches per minute, the current required varying with the thickness of material through which the needle has to pass. The counter E. M. F. at 2,400 revolutions = 9.2 volts, which gives a maximum efficiency of 85.5 per cent. In this motor, which is calculated for use with battery current, the field is wound in shunt relation to the armature, which has a resistance of .77 ohm. The motors are being made for battery, arc and incandescent circuits, and will be made in all sizes from $\frac{1}{10}$ horse-power upward.

PERSONAL.

Mrs. Florence Bond-Hurn, well known to many electricians in Boston, has resigned the position she held for 12 years as book-keeper for the Redding Electric Company. The resignation took effect Jan. 1.

Col. Rowland R. Hazard is the most redoubtable opponent to the Arcade system of New York. His "ferflax" scheme for shooting under Broadway has come into notice within a year. The colonel is a slender, wiry man who wears eye-glasses and talks "ferflax" under heavy pressure.—*Street Railway Gazette.*

Mr. W. F. Swift, the efficient Secretary of the Brush Electric Company, is making a protracted stay in the South in the interests of his company. His headquarters are at Atlanta, Ga., and any letters addressed to him by inquirers or others will reach him there. From the New Orleans *Picayune* of recent date we see that the Brush Company have placed an installation of 169 lights in the *Picayune* Building, which is highly commended by that paper.—*Iron Trade Review.*

M. Ed. Julien.—A farewell dinner was given to this gentleman by a number of his friends at the Union League Club, on Jan. 7, when a most enjoyable evening was spent. M. Julien returns to Europe to witness the opening of three of the street railways in Brussels fully equipped with his motor and storage system, and then will come back on another visit to this country, where important work and large opportunities await him. Since M. Julien was awarded his two diplomas at the Paris Exhibition of last year, he has received a congratulatory telegram, on the honor conferred, from King Leopold of Belgium.

The Late Hilborn Roosevelt.—The recent death of Mr. Hilborne Roosevelt, who was an old member of the Mendelssohn, received remarkably slight notice in the press, and yet, says a writer in the New York *World*, there have been few men of his day and generation who have been as widely or well known to New Yorkers, or who have done as much to achieve lasting recognition and remembrance. He was the son of the late Weir Roosevelt, a member of the old and well-known family of that name. Possessed of ample means, he did not become an idle man, but devoted himself and labored energetically to advance the cause of music in America. He invested most of his capital in an organ manufactory, and his organs are now to be found in many of the principal churches of the land. He built the two in Grace Church, the first which were so arranged as to be used as one instrument in this country. The magnificent organ in the Stewart Cathedral at Garden City was also of his building, and most of the important improvements in organ building during the past ten years were devised by him. An enthusiastic musician himself, he was a prominent member of the leading musical organizations of the city. Some four years ago Mr. Roosevelt married Miss Kate Shippen, the daughter of the late W. W. Shippen, President of the Hoboken Ferry Company, and who, with one child, a daughter, survives him. Their wedding took place on a midwinter day at Seabright, N. J., and will long be remembered by the hun-

dreds of guests who attended it, a special train conveying them thither and home again. For some years Mr. Roosevelt was the financial backer of the *Keynote*, which ceased publication recently. He was a member of the St. Nicholas Club and Society and of the Calumet Club. Dying at the early age of thirty-seven he leaves to his relatives and numberless friends the memory of a strong, kindly character, a pure life full of high aims and marked success in his chosen work. Mr. Walter Crosby, for many years his faithful friend and assistant, will probably carry on his business.

MISCELLANEOUS NOTES.

More Earthquakes.—Texas, Maryland and South Carolina have just had some more earthquake shocks.

Wichita, Kan.—The Archer Electric Manufacturing Company has been organized by N. A. English and others, with a capital stock of $60,000.

Chicago, Ill.—The Chicago Electric Company, interested in electrical goods, has been incorporated by E. W. Frowitt and others with a capital stock of $10,000.

Galvano-Cautery and Cancer.—A gentleman in Newark suffering from cancer on the left side of his tongue has just had the cancer removed successfully by galvano-cautery. He is now recovering from the effects of the operation, and is able to attend to work at his office.

The "Great Eastern" for Sale.—The Great Eastern steamship is finally to be put up and sold at auction on the 17th inst. She now lies in Kingstown Harbor, Dublin, where she went last fall. It is supposed that she will be converted into a storeship or floating hospital. In these days of huge ships, it may be interesting to know that none of them approach in size the Great Eastern, whose gross tonnage amounts to 18,915 tons.

New York Subways.—The appeal of the New York Electric Lines Company from the decision of Judge Allen, refusing to grant a mandamus to compel the Commissioners of Public Works to give the company a permit to open the streets for the purpose of laying conduits for wires, without regard to the Subway Commissioners, was heard by Chief Justice Larremore and Judges Daly and Bookstaver, in Common Pleas, General Term, on Jan. 6. Decision was reserved.

Opinions Quoted in All Electrical Matters.—Our lightning New York contemporary, THE ELECTRICAL WORLD has issued a neat pamphlet containing a history of the growth of that excellent periodical. It started in March, 1874, as *The Operator*, a semi-monthly, and in October, 1882, the name was enlarged to *The Operator and Electrical World*, and finally boiled down to its present size. The *World* has had a world of experience, and has come to the front a successful, reliable, independent journal, whose opinions are quoted in all electrical matters. It is now steadily and deservedly prosperous.—*The Milling World.*

SPARKS AND FLASHES.

Join the District Corps.—A subscriber asks us the question, "How can I prevent my boy from being fast?" Let him join the district telegraph corps.—*Sunday Breakfast Table.*

Trying His Patience.—Telephone: "Ting-aling-ling." Busy Clerk: "Hello! hello! What do you want?" Telephone: "Only trying the line." Busy Clerk: "Oh, beg pardon; I thought you were trying my patience."

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

Partrick & Carter, of Philadelphia, have just issued a very fine catalogue. Its size and its comprehensive character give an idea of the manner in which the business of this old, but ever young, firm has grown, and of the way in which it has kept abreast of electrical development. This catalogue should be in the hands of all dealers and consumers.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

January 11, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	35
Am. Tel. & Cable	73	76
Cen. & So. Am.	90	100
*Com. Tel	.....	.....
*Gold & Stock	90	100
*Inter. Ocean Tel.	85	.....
N. Y. Mutual	73	.....
Pac. & Atl.	48	55
*Postal T. & C.	30	35
South. & Atl.	66	75
W. U. Tel.	73¾	73⅞
W. U. Scrip.	65	.....
W. U. Bonds	.....	123
Mut. U. Bonds	84½	85½
TELEPHONE.		
Am. Bell	201	201½
Am. Speaking	112	120
Erie	27¾	28
*Hudson River	53	.....

TELEPHONE.	Bid.	Asked.
Mexican	1⅝	.....
*N. Y. & N. J.	87½	93½
N. Y. & Pa.	.....	.....
New England	44¼	44½
*Southern Bell	110	130
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	.....	.....
*Edison Ill	85	100
*Edison Isolated	.....	.....
*United States	35	.....
*U. S. Ill	97½	100
MOTOR.		
*Daft	.....	.....
*Sprague	.....	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED DEC. 28, 1886.

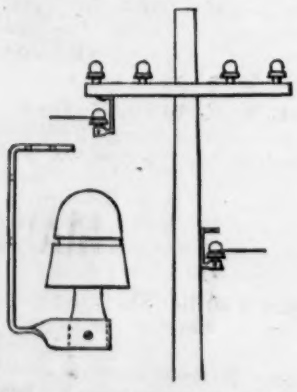
354,881. Electric Igniter for Gas Engines; Forée Bain, Chicago, Ill. Application filed February 17, 1886. The invention consists in an igniter having electrodes, conductors, circuit breaker, and a generator constructed to produce an igniting-spark by a single quick movement, thereby avoiding the objections incident to the use of magneto and dynamo generators. See illustration.

354,892. Underground Conduit; J. S. Du Bois, Camden, N. J. Application filed Nov. 17, 1885. The invention relates particularly to the means for supporting the wires and keeping them separate within the tube or conduit.

354,919. Circuit-Closer; W. B. Manny, St. Louis, Mo. Application filed July 3, 1886. The inventor designs to ring an electric bell by the operation of a knocker. The invention is to be used on the front door of houses. See illustration.

354,952. Electric Valve Controller and Thermostat Combined; Fred A. Price, Jamestown, N. Y. Application filed March 25, 1886. This invention is designed to automatically regulate the temperature of buildings by controlling the supply of hydrocarbon or natural gas, either in the main supply-pipe leading to the meter or in any of the rooms in which this combustible is used, the whole to be operated by a thermostat and an electrical apparatus capable of adjustment to any degree of temperature.

354,942. Mechanical Telephone Exchange; G. F. Shaver, New York, N. Y. Application filed Jan. 25, 1886. Relates to improvements in mechanical telephone exchanges from which radiate a number of wires for telephonic communication, and wherein any two wires may be connected, so that communication may be made from the remote end of any one of said radiating wires to the remote end of any other. For description see THE ELECTRICAL WORLD, Dec. 26, 1885, and June 19, 1886.



355,165. PIN HOLDER FOR ELECTRIC WIRE INSULATOR.

(1) 354,945; (2) 354,946. Dynamo Electric Machines; E. A. Sperry, Chicago, Ill. Applications filed Oct. 31, 1884 and March 21, 1884, respectively. The inventions relate to dynamo electric machines having cup-shaped electro-magnets with their opposite polar faces in the form of continuous circles, between which an annular drum-shaped armature is arranged to operate. See THE ELECTRICAL WORLD, Aug. 22, 1885.

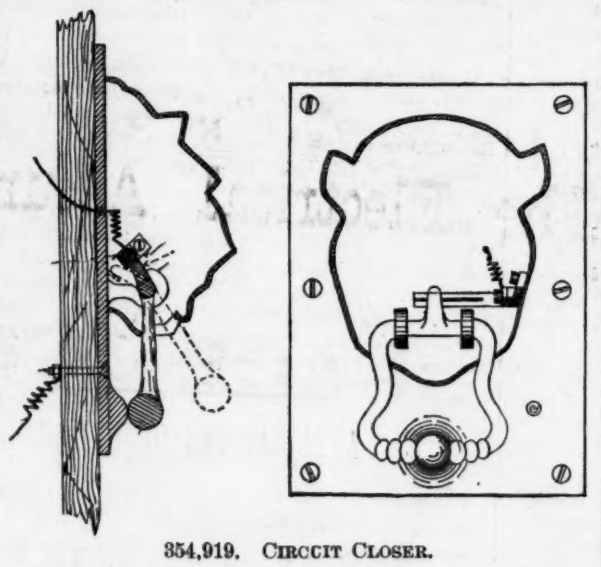
354,992. Railway Signal; S. T. Street, Deposit, N. Y. Application filed Dec. 14, 1885. The invention consists of an electrical signaling device for indicating the approach of railway trains at street-crossings or other places remote from the operating mechanism of the signal-circuit, which is put into action by passing trains.

354,996. Telegraphic Switch; John Absterdam, New York, N. Y., Assignor to Jeremiah M. Pelton, same place. For description see page 13, this issue.

355,024. Electric Motor; H. M. Paine, Newark, N. J. Application filed Sept. 28, 1885. A special construction of commutator is here designed whereby the effects of sparking are diminished, if not prevented, in order to guard against the oxidation or burning of the contacts, provision being also made for regulating the speed of the motor by devices capable of easy manipulation.

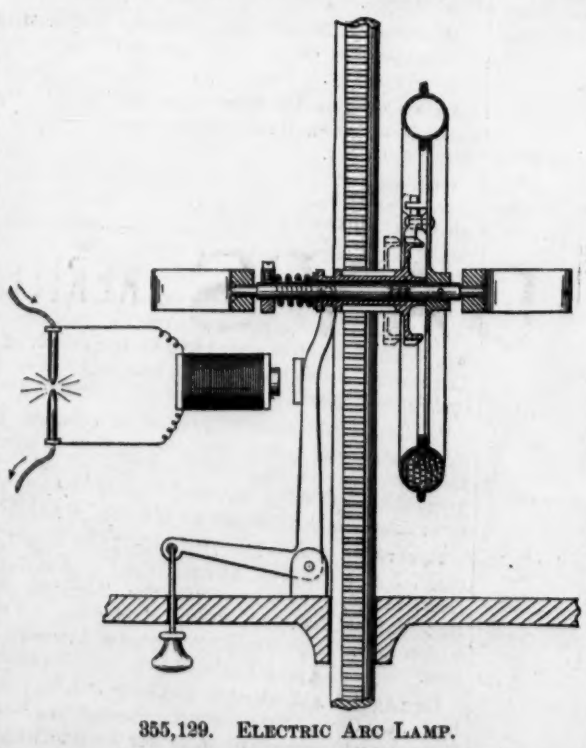
355,032. Telephone Receiver; H. A. Schneckloth, New York, N. Y. Application filed February 26, 1886. In order to produce clearer sounds, a permanent magnet is arranged on one side of the diaphragm and a tubular core on the other side, which ends in a trumpet-shaped end piece. The permanent magnet and tubular core are arranged with exterior primary and interior secondary coils, whereby the effective action of the receiver is increased.

355,055. Signaling Apparatus for Railway Trains;



354,919. CIRCUIT CLOSER.

J. H. Bickford, Salem, Mass. Application filed Feb. 15, 1886. This invention has for its object to provide a train of cars with signaling apparatus, whereby the engineer may be notified when to stop or start the train, and also to provide mechanism on some part of the train for ringing a bell located at a crossing or station, to indicate the approach of the train.



355,129. ELECTRIC ARC LAMP.

355,059. Electro-Therapeutic Appliance; J. Charles, Ridgeville, Ind. Application filed July 29, 1885. This is an electro-therapeutic appliance to be worn on the body. One or more electric batteries suitably shaped for being worn on different parts of the body, and one or more electrodes, also shaped to fit different parts of the body and common to all the batteries worn by the patient, are provided.

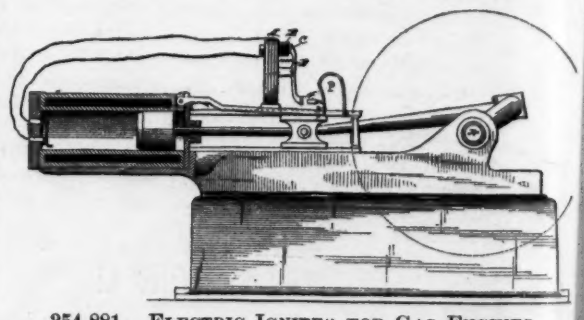
355,063. Underground Electrical Conductor; F. B. Crocker, New York, N. Y. Application filed April 17, 1885. Instead of making joints in the wires at the end of each section of conduit, the sections are constructed at the factory and strung on the wires. They are then folded over on one another for transportation. In laying the conduit, the sections are joined together by split couplings.

355,129. Electric Arc Lamp; J. Brady, Brooklyn, N. Y. Application filed March 6, 1884. The inventor has provided means for feeding the carbon rod smoothly and steadily, consisting principally of a balance wheel loaded with mercury or its equivalent connected with the operating gearing. See illustration.

355,149. Telephone Receiver; A. E. Dolbear, Somerville, Mass., Assignor by mesne assignments to the Dolbear Electric Telephone Co., of New Jersey. Application filed Feb. 15, 1882. The invention consists in coating both sides of the metallic diaphragm with a resinous material capable of holding a charge of electricity a considerable length of time, it being considered advantageous to keep the plate electrified while the electrifying agent is not acting.

355,164. Electric Heat-Regulator; Rich. L. Guion, Elmira, N. Y. Application filed April 7, 1886. This is a combination of a thermostat with a clock-work provided with cams for engaging an armature which controls the valve for admitting heat.

355,165. Pin-Holder for Electric Wire Insulators; Mack Hanks, Buffalo, N. Y. Application filed Oct. 20, 1886. This invention is a metal holder or bracket for the screw-pin and insulator to be screwed thereon, in use principally on telegraph lines. The bracket may be secured to any portion of a telegraph pole or to the cross-arms, or it may be fastened to a window casing or to a brick wall by screwing between the bricks into the mortar. See illustration.



354,881. ELECTRIC IGNITER FOR GAS ENGINES.

355,172. Electric Arc Lamp; R. F. Jones, St. Louis, Mo. Application filed Aug. 7, 1886. The principal feature in this invention is the provision of a clamp for gripping the carbon and means for operating the clamp so that a uniform pressure upon the carbon is maintained regardless of irregularities in its size or diameter. The invention is intended as an improvement on letters patent previously granted to the same inventor.

(1) 355,189. Telephonic Apparatus; (2) 355,190. Telephonic Appliances; J. F. McLaughlin, Philadelphia, Pa. Applications filed respectively May 29 and June 9, 1886. 1. The inventor designs to increase the sounds in volume and intensity by arranging large diaphragms in air chambers which concentrate them at a certain point. 2. Means are provided for cutting out at will either the receiver or transmitter.

355,226. Telephone Check Apparatus; D. J. Smith and D. Sinclair, Glasgow, Scotland. Application filed April 2, 1886. The object of the inventors in this case is to provide means for enabling the operators in telephone exchanges to check the payment of charges made for the use of telephonic communication in public call boxes and offices connected to such exchanges, and the time during which the telephone is used on each occasion, while also permitting of the free use of the call box telephones by subscribers to the exchange system.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnson's Patent Agency, Potter Building, New York.